THE PRACTICAL TEACHER

With which is incorporated

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Educational Opinion.

THE recent death of Dr. W. T. Harris, a former Commissioner of Education in the United States, has removed one of the most indefatigable workers in the cause of education that the world has ever known. His energy was almost Titanic. There can be hardly a reader, researcher, or worker in this field who at some time or other has not been indebted to the stream of reports, investigations, statistics, and summaries which poured from the office of the United States Commissioner during the years 1889 to 1906, when Dr. Harris was at its head. For these riches were lavishly placed at the disposal of all who wished to profit by them, and in this respect Dr. Harris was, in a way, a sort of educational commissioner for the teaching world at large. He did not confine his energies to any one direction; his finger was on the pulse of educational life generally; and his stimulating personality made itself felt in most multifarious ways. As president of societies, leader of conventions, universal adviser, writer and editor of books, preface writer and helper of younger authors, this extraordinary man seemed to combine in his own person a whole world of personalities and diverse energies. He made his mark on American education, and he will be remembered along with Horace Mann, that other great worker among transatlantic educators.

A Notable Worker.

HARRIS came from that seed-bed from which so many of the great moral forces which have gone to the shaping of the United States have sprung—New England. It was St. Louis, however, which saw the rise of his activity; for he worked there as a teacher, forcing his way upward, rank after rank, till he became superintendent in charge of the city's educational work. It was here that he gave the first proof of his quality as an administrator, and doubtless this experience stood him in good stead when he was appointed commissioner by President Harrison. This was a post which gave him the scope his administrative abilities demanded, and he seems to have revelled in it—he had come into his own at last.

A Man of Energy.

Dr. Harris was well known on this side of the Atlantic. The writer remembers him on a visit to England a good many years ago, when his irrepressible activity fairly astounded some of the professorial staff of one of our northern universities, for his insatiable appetite for information, and the energy which seemed to stream from him, presented little in common with the type of educationist as conceived in England, whether official or professorial. In a measure, Dr. Harris was typical of the American public man—possessed of untiring strength, tremendous driving power, unflagging enthusiasm, and the apparent power of multiplying himself by a number that the moment required. He was certainly a most notable worker, and the world of education is the poorer by his death.

A SHORT time ago the headmaster of Eton made the statement that "the widespread inability to read aloud is a peculiarly English characteristic." It seems strange that with a language so strong and supple as English, with a literature that is one of the very first in the world, and with a reading public of enormous size, any one should be able to say such a thing. Perhaps the Head of Eton was speaking from his experience of Eton, in which case we have nothing to say on the matter. But we are fain to confess that "as a fine art" (which it really is) reading aloud is neither much nor very successfully practised in these recent years of grace. And yet a generation ago it was a very necessary accomplishment, and one of fairly general occurrence. Why should it decline now? Perhaps it is the hurry and scurry of modern life which is to blame. The typewriter and the flood of daily correspondence have destroyed caligraphy. Few of us are likely to be recommended for high appointment, like Roger Ascham, by our beautiful handwriting. The hectic way in which we read, tearing out the gist of what is before our eyes and then tossing away book or paper to take another, does not lend itself to reading aloud, which requires a certain leisure, not only physical, but mental, for its performance. To read aloud one must have time to taste what is being read—to turn the morsels on the tongue, so to speak; but most men's reading is a series of hurried sips. Perhaps, after all, it is with reading aloud as with music. The capacity to enjoy music is more widely spread than ever, as also a certain degree of skill in it; but we tend more and more to delegate the executive art to those who make a profession of it. It would seem that we are doing so with reading and reciting. But it is a pity.

A Lost Art.

CHINA has long been known as the paradise of examiners—a country where examinations are the key to preferment in everything. No wonder that the schoolmaster, the imparter of Chinese learning, has been held in high honour. According to one of the British consuls, he is changing with the times, and, abandoning the accumulated wisdom of four thousand years of Celestial study, he is beginning to offer newer wares—the wisdom of the "foreign devils." In plain language, all along the fringing sea-coast, and on the banks of the Great River, where Chinese are more closely in touch with foreigners than elsewhere, schools are springing up under the initiative of the Chinese Government, where the staple of instruction is "Western" knowledge. It is well known that there have been for a long time schools managed by Europeans. The novelty is that the government is itself stimulating the formation of schools which are officered by Chinese. And, by way of assuring their success, privileges are granted to them which the outside establishments do not possess—an astute move on the part of the Celestial innovators. Once again here is a tribute to the power of the school and the schoolmaster. Much has been said and written on the "awakening of China," and in very various keys. After all, the awakening there, as everywhere else, seems to be in the hands of that humble but really omnipotent official, the schoolmaster.

Chinese Schoolmasters.

THE difficulties attendant on the problems raised by medical inspection as exercised under the London Authority are receiving confirmation from other quarters. Dr. Ritchie's report for the city of Manchester supports the statements of Dr. James Kerr and his colleagues. The parent—a certain class of parent—is the stumbling-block. The condition of the home determines the condition of the child, and the home depends on the parent. Without saying a word against those whose condition of desperate poverty prevents them from doing what they would, and who will undoubtedly have to be helped by the local authorities, there are those who seem determined to do nothing to ameliorate the physical conditions under which their children are growing up. For this class of parent the Manchester authorities devised a plan of treatment. After warnings, which were disregarded, the worst cases were reported to the N.S.P.C.C., who put the law into operation as in ordinary cases of cruelty, with beneficent results. Parents must be case-hardened against whom such proceedings have to be taken; but any plan is good that will prevent, even to a small degree, the terrific waste of the nation's finest asset—the health, physical and mental, of its young ones.

A Plan for Defaulters.

THERE are illuminating sentences in the report of the last meeting of the London Education Authority. In 1907 there were 1,100 candidates for 850 places on the "college list," and 1,600 for 750 places in 1908. In 1908 the list was formed of 58 per cent. London trained men and 42 per cent. provincial; 64 per cent. London trained women, and 36 per cent. provincial. "It has been laid down that, in the interests of the service, there must be free competition, and no restriction to teachers trained in the London area." But it is just this free competition which is lacking. The conditions under which the 42 per cent. of men and the 36 per cent. of women were chosen were such as strictly to preclude anything like competition at all. The only way to allow free competition is to abolish the list altogether, when London trained and provincial trained would compete openly, and the best of those who wish to work in London would obtain the posts. To talk of free competition under any other conditions is to "pay oneself with words," which deceive nobody.

The College-trained once more.

WHAT a power a rural teacher can be! And often is! The fact was brought home with tremendous force to the writer in a journey just undertaken through one of the counties, almost exclusively agricultural. The sturdy, independent types; the influence wielded, not only due to position, but due to strength and personality; the general respect for office and character manifested by the population of the villages—these things revealed themselves with extraordinary vividness, even in small, remote villages where the physical difficulties of the surroundings might have produced a completely deadening effect on character. If some of those college-trained students who sigh for the life of the towns could only be brought to see what a magnificent field of work lies open to them in the country districts, we might hear less of the glut of applicants for the smallest post in a town, and a corresponding loss of bitterness among a few of those who have been left stranded after college days are over.

A Tribute to the Rurals.

THE "well-educated youth of sixteen," who has been applying for junior posts in public libraries, has been giving trouble again. His notion of the "home counties" is drawn from the football field. Home counties are county Rugby teams playing at home; and as for "Tower Hamlets," they are, in the opinion of this well-educated young gentleman, "the cottages in the Tower of London grounds set off for the use of soldiers' families"—a fact which would astonish the population round Tower Hill. He seems confused about Waterloo—the battle, not the station. According to him, Nelson was killed there, and Washington fought it. But he put in a saving clause to the effect that "Washington was formerly nown (*sic*) as Wellington," which doesn't improve matters much. He is equally at sea about the Cape of Good Hope, and, indeed, he seems to have nonplussed his examiners, who call for his blood or that of his teacher. Some one is to blame, and we sympathise with the members of the Library Association if this sort of "well-educated" youth is to be let loose among the shelves of our public libraries.

The well-educated Youth.

NATIONAL HOME-READING UNION.

(*To the Editor of "The Practical Teacher."*)

SIR,—We are sure that your readers will be interested to know that this session marks the coming of age of the National Home-Reading Union. The Young People's Book List just issued is the twenty-first of the series; and although the work of the Union is now well known throughout the country, we venture to ask for the freedom of your columns, not only to announce this interesting fact in our history, but also to acquaint your readers with some recent and important developments in our work.

The Union has made an exhaustive investigation into the whole question of juvenile literature in this country, and especially with regard to the cheap journals which circulate among our schoolboys and young working lads. Like every one else they had been aware of the existence of the "penny dreadful," or "blood" as it is now called, but the magnitude of the evil was not realised until the inquiries above mentioned were made. Cheap boys' journals and so-called "comics" at a penny and halfpenny circulate by the million. They are replete with every kind of sensationalism; they make a feature of crime stories; and their absurdity and vulgarity are almost beyond belief.

The National Home-Reading Union feels that the only successful method of meeting this great evil lies in providing for our scholars an abundance of good, healthy, and interesting books. This has been the object in view, not only in the selection of the books on our current list, but also in the magazines which contain articles dealing with the books.

Then with regard to the Union's system of forming Circles. It will generally be admitted that it is not sufficient to put books into the hands of children without giving them some training in the art of reading. Children have a habit of skimming a book, rather than reading it with that care and attention essential to profitable reading. It is to prevent this habit that the Union recommends the formation of Circles, and the Board of Education has strongly advised that these Circles be formed in our schools.

By this method the book chosen is carefully studied; and not only are the ordinary difficulties of language explained, but the teacher also points out striking beauties of style and diction, the force of metaphors and imagery, the personal characters are exhibited, and the humour and pathos that occur commented on.

We shall be very glad to give further information about our work amongst children (and others), and would appeal to all who are interested in and realise the value of it to co-operate with us in it in one or more of the many ways in which co-operation is needed.—Yours faithfully.

[J. B. PATON, D.D., *Hon. Secretary.*
A. M. READ, *Secretary.*

The Rule of the Children.

DEAR HANS CHRISTIAN ANDERSEN. DEAR CHARLES LAMB.

DEAR ROBERT LOUIS STEVENSON

When the first baby laughed
for the first time, the laugh
broke into a thousand pieces,
and they all went skipping about,
and that was the beginning of fairies.

DEAR LEWIS CARROLL.

A Quotation from the Sampler of Wendy Moira Angela Darling.

ON the curtain which falls upon the succeeding Acts of *Peter Pan*, and which shows the sampler of Wendy Darling, aged nine, there is a space, occupied for the moment by the conventional needlework trees, which the delighted spectator would fain fill with the words DEAR J. M. BARRIE. For if Andersen, Lamb, Stevenson, and Carroll have given pure delight to thousands, the same claim may surely be made for the author of this entrancing fantasy, now in its sixth year of production.

The author has done more than delight thousands of children. He has set a fashion in matters theatrical which, to our mind at least, is entirely good. For the holiday season in the present year no less than four of the principal London theatres are given up to the children, and are drawing crowded audiences at almost every performance. And the fact that comparisons cannot be made owing to intrinsic differences of theme and setting speaks volumes for those who have provided the material for the plays. We have seen and enjoyed three of these productions, and to compare them would be as futile as it would be ungracious and unnecessary.

The story of "the boy who wouldn't grow up"—if, indeed, there is a story—is known to most grown-ups as well as to numberless little ones throughout the country. There is no necessity for us to give it, even in outline, here. Its delicate fancy has captivated the hearts of all who have kept their youth in spite of experience. Its drollery and delightful absurdity have evoked the merriest peals of innocent childish laughter which have ever echoed within the walls of a public building. The sternest moralist can find in it a sermon suited to his taste. The most imaginative can revel in its poetry.

It is good to hear the comments of the juvenile audience, and to note how surely the author of *Sentimental Tommy* understands the things which make appeal to children of varied tastes and temperaments. If all educators were to follow his method of "child study," what a revolution in our educational system there would be! How delightful a study it is when professional educators are not by, and the jargon of the textbook does not come between the student and his subject!

Scarcely a hundred yards from the home of *Peter Pan*, children of all ages are flocking to enjoy another dramatic spectacle, which bears the title *Where Children Rule*. Here, again, we have evidence of careful, patient study of the things which delight the heart of youth.

MARJORIE DANE AS THE QUEEN OF THE LAND WHERE CHILDREN RULE.
(Photo by Daily Mirror Studios.)

There is no attempt to instruct. The only moral lesson we could detect was that it is rather advisable to pay the rates with regularity, a matter with which

PETER PAN ON THE PIRATE SHIP.
(Photo by Bassano.)

children have no real concern. For the rest, the play was a merry romp from beginning to end—a peep into a land of topsy-turvydom, where the little ones command the big ones, and show them how nonsensical are many of the regulations with which they curb and hamper the soaring fancy flights of imaginative childhood.

It was a piece of inspiration to make the hero, David, a Boy Scout; for these very serious would-be defenders of our shores are extremely popular at the present moment, and get a better education from General Baden-Powell than is afforded by Sir Robert Morant and his lieutenants. Now this same David, and Elizabeth, his younger sister, have a couple of parents not nearly so serious, sensible, and responsible as their children; and when their grown-up stupidity becomes too bad to bear, the boy and girl make up their minds to take "the first turning out of London" for the "land where children rule." David has scouted the place and knows all about it, and under his capable guidance his little sister is entirely safe.

In due time they reach this delectable country, and then the real revels begin. The land is under the rule of a queen, chosen for the overwhelming beauty of her dimples; and after a month of London fog this little maiden's smile was good to see. Here the children lord it over those grown-ups who are kept prisoner for the improvement of their characters. A very tall huntsman, Mr. Jorrocks, is taught by a very small boy in knickerbockers how cruel a pastime hunting really is. Another erring grown-up is sent to bed, and, proving fractious there, is privately chastised, having first been told that his punishment hurts the operator more than it is going to hurt himself. Other Olympians are corrected according to their deserts, and when the "idea" of the piece tends to become too prominent several delightful digressions are made.

Queen Elizabeth takes the centre with Drake and Raleigh, and the latter acts the courtier with the cloak in the most approved history-book style. Then comes Henry the Eighth with all his wives at once! He was the aforesaid queen's "ancestor," as Wendy would put it; but seeing that the school lies outside the gates of "the land," chronological order is not observed. This pocket edition of "bluff King Hal" is entirely delightful. Following him we have Nelson and Hardy, who, with a few jolly little tars, group themselves into the death scene as immortalised by Maclise, and then, rising suddenly, dance a hornpipe in the most approved manner of their period.

Of course there is a villain in the piece, and, to our shame be it said, he is none other than the schoolmaster, who fetters his pupils by the ankles in much the same way as his methods fetter their imagination. Having gained admission to "the land" by a trick, he finds out that the spell which gives the children authority over the grown-ups lies in the dandelion "clocks," and forthwith proceeds to collect them all in a sack, with the object of carrying them outside the gates of the topsy-turvy country. How his fell designs are frustrated must be discovered by our readers when they are fortunate enough to have an opportunity of seeing the play for themselves.

PETER PAN ESCAPES FROM THE ROCK.
(Photo by Ellis and Walery.)

There is a delightful episode near the end of the play, when the queen is threatened with deposition because a child has been found whose dimples, it is

Bobbie Andrews as David (Boy Scout).
(*Photo by Daily Mirror Studios.*)

alleged, are prettier than those of her majesty. How the malign plot is exposed must be discovered by a visit to the play itself. As an observer of children, I was struck with the play of emotion royally suppressed which characterised the extremely youthful player throughout the crisis.

Indeed, the characteristic of the whole piece was the unaffected acting of the children. The question arose to my mind, Shall we use this innate love of pretending in the business of education, or shall we leave it alone for those delightful hours of play in which no grown-up can truly share? As soon as the adult organiser comes into the game it is a game no longer, and all

the fun is spoilt. This was clearly shown in an incident of the very play which I am considering. David's father is a sad bungler at the game of "Let's pretend," and his son brushes him aside with as much contempt as the rules of the Boy Scouts will allow him to show.

Last year I tried to give readers of the *Practical Teacher* some idea of that other juvenile play, which is entitled *Pinkie and the Fairies*. This has been revived for the present season, and is now fresher than ever. Those who wish to gain some idea of the nature of this production might turn to our number for February 1909. They will also find in the book of the play (published by Mr. Heinemann at one shilling) several dainty lyrics, which might serve as school recitations in place of some of the so-called "poetry" now inflicted upon young pupils. Here is one from the number:—

"Daffadowndilly is sad to-night!
Heigh Ho, Daffadowndilly!
Sad for the sun and his golden light,
For the moon is pale and the stars are white,
And the kiss of the dew falls chilly.
Daffadowndilly is nodding his head,
Shedding a tear as he turns to his bed.
Heigh Ho!
Night winds blow
Over my Daffadowndilly.

"Daffadowndilly, the day will rise,
Peep Bo, Daffadowndilly!
Lighting his lamp in the eastern skies,
Fighting the slumber from drowsy-droop eyes,
Warming my Lenten Lily.
Daffadowndilly in robe of gold,
King of the meadow his court will hold.
Peep Bo!
Sunbeams glow,
Waking my Daffadowndilly."

Next month I hope to give my readers some idea of Maeterlinck's *Blue Bird*, which is drawing large audiences at the Haymarket Theatre. This also is said to be a children's play. But we shall see.

A USEFUL PERIODICAL.

It is now generally realised that education in its highest sense should embrace not only dead rules and set formulæ but a lively understanding and appreciation of the world as it is to-day—of the great achievements and changes in science, in exploration, in commerce and politics which are making history and perceptibly or imperceptibly changing the lives of us all.

As an index and guide to progress for men and women of intelligence, the monthly magazine known as *The World's Work* has long been recognised as holding a unique place, and has often been recommended in these columns. Its value as an educational instrument for use in the higher classes of schools is now gaining recognition from the foremost educational authorities of to-day.

In dealing with the subject of elementary science and commercial geography, the magazine has been found helpful by many teachers. The articles on agricultural science are particularly valuable for country schools; whilst the up-to-date illustrated descriptions of places and manners abroad form a most convincing and attractive adjunct to a geography lesson. The artistic illustrations are found useful in the drawing lesson.

The subject-matter of articles and photographs forms excellent material for essays. The magazine provides eminently suitable matter for those conversational lessons on up-to-date topics which are a feature in most curricula. Extracts from such issues as the recent aviation and Empire numbers, when affixed to the notice-board of classrooms, are valuable as furnishing, in an interesting and picturesque way, the very latest information on these topics. The same principle can be applied to many such subjects, on which there are either no text-books or what there are become quickly out of date.

The New Constructive Movement.

SUGGESTIONS FROM AMERICAN SCHOOLS.

BY W. H. WINCH, M.A.

THE Constructive Movement grows apace. By the time this article is in print many of my readers will have heard or seen Professor M. E. Sadler's lecture delivered at the North of England Education Conference, on "The Relation of Elementary Schools to Technical Schools." Very appropriately the paper was read at Leeds University—one of the growing number of English universities recently established, in which learning and teaching are directed more specifically than at the older universities towards practical and business ends.

But it is not merely at the younger universities that practical issues and practical work are tending more and more to become dominant educational ideals. At the recent Headmasters' Conference the heads of the great public schools of England—the word public in this sense always puzzles an American, because, as he says, these schools are not public—during a consideration of the report of their committee, showed many tendencies toward practical reform. The critic of *Nature*, a little hopefully, as it seems to me, wrote at the close of his account of their discussions: "Perhaps we may not have to wait many years before drawing, nature study, music, and handwork are accorded the status of essential subjects in the preparatory curriculum." Preparatory here means, of course, the preparatory schools and classes attached to the secondary and private branches of English education.

The benighted elementary school teacher, cramped within the meshes of State regulations, taught all these things long ago, and it will be cheering to him to find the headmasters, who have merely educational ideals to obey, tending in the same direction.

But more important and significant still, especially to the public teacher, are the recent recommendations of the London Education Committee. Central schools are to be established in London—schools which shall have an industrial or commercial bias, or both. Practical and manual work are to be taken in all of them, and the girls are not to be allowed to omit the continuance of their domestic training. Parents will be permitted to choose whether their children shall attend a central or a secondary school, as bursaries are to be available for the former as well as for the latter type of school.

This is a long way from the manual training high school of America, which I hope to describe in a later article, but it is a great step forward in the general Constructive Movement. Indeed, the danger may soon be—dare we hint it—that the new central schools may tend, just as the higher elementary and higher-grade schools have tended, to exclude some of the necessary elements of a good elementary English and humanistic education in favour of some premature forms of specialised instruction.

But to be forewarned is sometimes to be forearmed. Let us hope that our newer schools will hold a juster balance between knowledge and practice—and that they will be educationally constructive throughout—for our Constructive Movement includes more than merely manual constructiveness.

Those teachers, then, who have thrown themselves enthusiastically into constructive work may feel fairly sure that they are swimming with a flowing and not an ebbing tide.

But with all this we have still, in the vast majority of cases, an awkward break still existing between the kindergarten work of the infant school and the manua and practical work of the children in the upper standards of our senior schools.

And with a few exceptions, this is also the case in the United States. In the November number of the *Practical Teacher* I instanced a case—that of a small city, in which the syllabus of practical work ran throughout the standards—and gave a short summary of the organisation and teaching of the classes in manual instruction. I will ask the reader to turn to that account, if possible, before going on with this article. There may come a time in England—indeed, the time is, I think, rapidly approaching—when the manual work of our upper standards will not be, as it now is, practically limited to wood-work. Even then it is probable that special teachers will be required for these classes—teachers who, I hope, will be *teachers* as well as dexterous workers in handicrafts. But for the great bulk of the constructive work in schools the usual teacher of the class must be, and will continue to be, relied on. And it is the teacher of the lower standards who will feel the strain of adaptation. Now, I do not for one moment suppose that when one has adopted a syllabus, and made, or caused the children to make, some more or less attractive "things," that all the demands of the New Constructive Movement have been met. We can construct in arithmetic, we can construct in geography, we can even construct in history. (A teacher who has read this said, with a not quite ingenuous smile, that his pupils have often constructed in history.) We can construct in drawing—not, by the way, in drawing the mere appearances of objects—that is a matter requiring the analysis of sensations, and not of constructive synthesis. But we want to construct *things* as well, and I propose to give the sort of making that is set out to be done in Milwaukee, in the state of Wisconsin. I daresay no experienced teacher will read the syllabus without a running fire of criticism; but in spite of that, perhaps partly because of that, some suggestive adaptations may come out of its perusal.

Grade I. children are six and seven years of age, Grade II. are seven and eight, and so on. All the classes up to, and including, Grade IV. are mixed.

SYLLABUS FOR MILWAUKEE, WISCONSIN.

Grade I.—*First half-year.*

Model 1. Needle-case. Materials required—Manila paper, rug needle No. 18, 4-ply Germantown yarn or coloured raffia.

Model 2. Holder: Plain weaving. Materials required—Tag board or stiff cardboard, 8-ply Germantown wool, rug needle No. 18.

Grade I.—*Second half-year.*

Model 1. Fancy weaving on nail looms. Materials required—Loom 12 in. × 6 in., Germantown yarn, weaving needles.

Model 2. Book covers or booklets. Materials required—Manila paper or Bristol board, scissors, paste.

Model 3. Clay modelling. Materials required—Clay, a board 9 in. × 12 in., or a piece of oil-cloth.

Model 4. Paper-cutting for expression.

Grade II.—*First half-year.*

Model 1. Carpet yarn rug. Materials required—Wooden loom 9 in. × 12 in., carpet warp or plain string rug yarn, weaving needle.

Model 2. Foot rule. Materials required—Cardboard, scissors, lead pencil, ruler.

Grade II.—*Second half-year.*

Model 1. Doll's bed blanket. Materials required—Germantown yarns 8-ply, two colours; cardboard 9 in. × 12 in., rug needle.

Model 2. Birthday booklets. Materials required—Plain white paper, coloured Bristol board, rug or darning needle.

Paper-cutting and clay modelling.

Grade III.—*First half-year.*

Model 1. Envelope for hammock. Materials required—Manila paper, paste, scissors or knife.

Model 2. Doll's hammock. Materials required—Seine twine, hammock board 8 in. × 10 in., two brass rings, rug needle No. 18.

Paper-cutting and clay modelling.

Grade III.—*Second half-year.*

Model 1. Splint baskets. Materials—Ash splints ½ inch or 1 inch wide.

Model 2. Knotted raffia bag.

Paper-cutting and clay modelling.

Grade IV.—*First half-year.*

Model 1. Sewing on buttons.

Model 2. Weaving silkalene or rag-rug. Materials—Loom 9 in. × 12 in., silkalene or rags ¼ or ½ inch wide, carpet warp or cord, weaving needle.

Model 3. Braided raffia or paper book-mark.

Grade IV.—*Second half-year.*

Model 1. Raffia basket. Materials—Raffia, natural or coloured; needle.

Model 2. Button-bag. Materials—Gingham plain.

Model 3. Book-bag. Materials—Raffia.

(*To be continued.*)

SPANNING THE GULF;

OR, KINDERGARTEN INSTRUCTION FOR THE UPPER STANDARDS.

BY H. G. STYLES.

(*Continued from page 237.*)

[The Editor regrets the enforced omission of Mr. Styles's interesting and helpful contribution from the last two issues. In the following article directions are given for the making of apparatus and charts, as this part of the work is to be done indoors, and is therefore more suitable for the present climatic conditions.]

BEFORE proceeding any further I wish to call attention to the Plate 1a in the November issue. For the convenience of the reader the lettering and figures are placed just the reverse way to that in which they appear to the pupil when working. He must start with the star, which denotes the Albert Memorial, *nearest his body*. Commencing at A, the distance to the first side path is measured.

One of two boys measuring calls out *sixty feet*. This is repeated by the teacher, who should then demand what length on the paper will represent that distance. The boys are then told to draw a *light* line right down the *left side* of the paper, and mark the end nearest to them A, the other B. The teacher now calls out:—

From A mark off a distance of 3", and figure it 60 feet.

The width of the side path will be next measured, and entered as before. From the farther edge of the side path two measurements are next required, one to the tree, another to the seat, and so on.

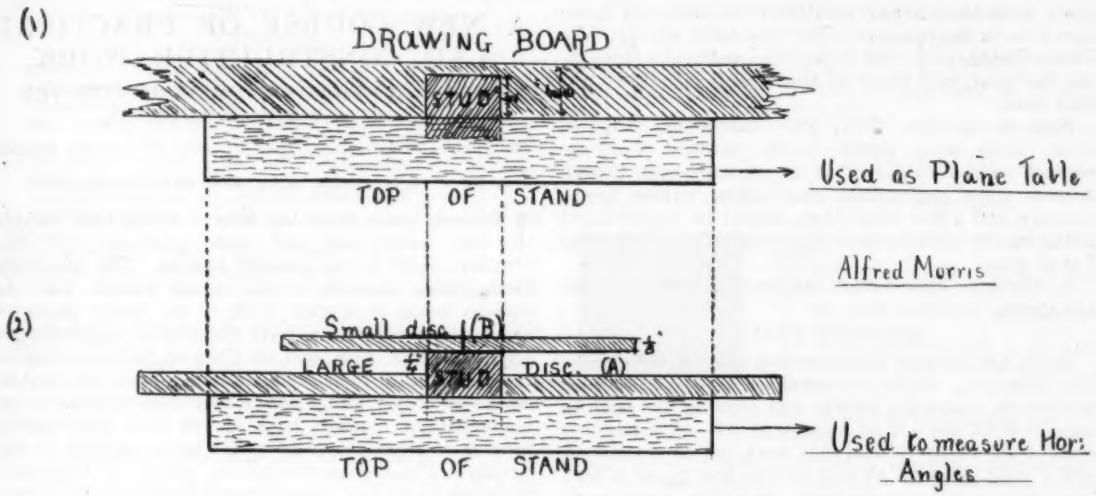
If there is time, the class should go back to the starting-point, and measure the right side of the path, or finish it on another occasion. At a later period the same exercise can be drawn to a different scale in school, and the path tinted yellow, the turf green. This affords an opportunity for correlation with drawing and brush-work.

It is necessary here, perhaps, to point out that the exercise is given solely for the purpose of affording practice with the tape, and representing length to a simple scale. It is in no sense of the word a correct plan of the path. No attention has been given to *direction*, and the width across the path has been disregarded. Later on, and in conjunction with exercises on *direction*, these and other details will receive proper attention. If preferred, the dimensions could be taken by pacing, in which case a scale of ·15" to a pace would have to be used. This, however, would only give *approximate* lengths, as is always the case when pacing, and is therefore not to be recommended for regular purposes.

Ex. 12. To measure and draw to scale a plan of the flower beds on the Park Lane side of Hyde Park. (Plate 1, page 180, October issue.)

I have previously referred to some of the difficulties we encountered in attempting this exercise. Here are others. The surrounding path was narrow, and continually occupied by pedestrians other than ourselves; and last, but certainly not least, the order, "Keep off the grass" rendered it necessary that a special method of working should be adopted if we were to be allowed by the officials to accomplish our task.

The difficulties were overcome in the following manner. The boys worked singly and in a line, following each other. Pacing was substituted for the tape, and the



(1). Showing how stud lies below top level of Drawing Board

(2). Showing how stud protrudes beyond top of large wooden disc. and allows small disc to stand on it without touching lower disc.

N.B If drawing is not more than ½ inch thick then the stud must be only ⅜" and the disc in proportion

dimensions were taken *from the edge of the grass plot* next the path. Each boy used a compass in addition to his ruler and pencil, and the names of the flowers and shrubs were obtained from the workmen as we proceeded. The diagram (Plate 1, page 180, October issue) shows clearly the full scope of the exercise, which, obviously, is much more difficult than the previous one. The widths of the beds had to be judged by pacing across one end; but as they were nearly all uniform this was not a very difficult matter. (A model of these beds has since been made in cardboard.)

The following week we made use of the arithmetic lesson for calculating the total area of soil and turf. This afforded excellent practice in the use of Πr^2, as may be seen by a careful scrutiny of the shapes involved. It is in this way that correlation can be made a reality; and I can assure the reader that the exercise in arithmetic, though extremely involved and lengthy, was honestly and heartily attempted by each boy, without any pressure being necessary on the part of the teacher.

Class-room Exercises.

In this and the following two or three articles I propose withdrawing the outdoor exercises, and substituting hints and exercises suitable for the classroom. From the beginning of November until early spring the conditions of climate in England will be found, generally speaking, unsuitable for outdoor work. This is the time for making apparatus, charts, graphs, etc., using the data obtained during the summer and autumn months. Of course, those who have not yet commenced, or, having commenced, have only done a limited amount of work, will have to devote attention to the making of apparatus and models, and in this direction there is plenty to be done. Here is a list of apparatus, etc., to think about. The items marked * are indispensable, and the sooner they are made or purchased (the former for preference wherever possible) the better.

* A1. Plane table.
* A2. Apparatus for measuring horizontal and vertical angles.
* B. Ruler, with sights.
* C. Clinometer.
* D. Levelling staves.
E. Rain gauge.
F. Water barometer.
G. Mercury barometer.
* H. Cardboard quadrants.
I. Model to illustrate North Pole Star and Great Bear.
* J. Models to illustrate contours and sectional elevation of mountains.
K. Model to illustrate equation of time.
L. Scholars' small globe on pedestal.

The making of apparatus, models, charts, etc., is that branch of the subject which falls under the head of "Manual Skill."

My time-table provides for two hours' work in the open air on one morning each week during the months from April to November, under the head of "Sketching;" and during the winter months the same time is used for making models, apparatus, and charts under the head of "Applied Art." Some of the apparatus is partly made at the Manual Centre, while many of the boys devote their leisure time during the long evenings to the same purpose. For example, three very creditable models—two of the Speke Monument, and one of the fountains and lakes in Kensington Gardens—have been

made since the summer vacation from measured drawings done in the open air. The time-table also provides for two lessons each week in practical arithmetic throughout the year, and much of the mechanical drawing is then done.

Now to the list. Gloy, glue, cardboard, strips of wood, silver sand, papier-mâché, sawdust, knitting-needles, spirit-levels, assorted screws, screw-eyes, thread, scissors, metal protractors, glass tubing, rubber bands, mercury, and a few other items, should be requisitioned if the reader contemplates following *all* the directions I shall give.

At the same time a start can be made with less than the above.

Apparatus A1, A2.

These are perhaps indispensable, and should receive first attention. So far our exercises have only afforded practice in measuring lengths and drawing the same to scale. With the aid of apparatus A1, A2 something more in the nature of real field work can be attempted, and a good groundwork laid for the making of a map from measurements in the field. It will be remembered that under the head of "Geography," "the making of a map" is suggested by the Department in the "Suggestions to Teachers." I have tried to exclude such exercises which might be considered as taking the pupil beyond the legitimate scope of elementary school work.

Now the ordinary millboard (see page 181, October issue), suspended from the shoulders as explained, does not allow the pupil to carry out exercises involving the use of a sighted ruler or magnetic compass. Such exercises require a plane table. For the benefit of those who have never used such a table, I may add that it is simply an ordinary drawing-board which revolves on the top of a tripod stand, and capable of being fixed in any horizontal position by a screw working from below. It is possible to obtain a plane table from Philip Harris of Birmingham for ten and sixpence, and where funds are available, the purchase of at least one such table is advisable. Having seen and used the real article, many teachers could, I am sure, devise a suitable substitute for less than half this amount. The real difficulty lies in the mechanical arrangement for clamping the board in any position, and I have not succeeded in doing this yet. I hasten, however, to assure the reader that much can be done with the home-made apparatus I am about to describe.

It consists of an equilateral triangular top (D), hinged to three legs, spiked and clamped with iron wire ¼" diameter when in use. In the centre of the top D a wooden stud is fixed, upon which a millboard or drawing-board revolves. This stud is marked in elevation and in plan. Now everything depends upon this stud being the right height above D, and having such a diameter that the board revolves *with some little difficulty*. If too narrow, then the board turns so easily that the slightest touch puts it out of position, thus rendering it useless as a plane table. Further, it must lie below the top surface of the drawing-board, otherwise it would prevent a sheet of paper being pinned to the board. At the same time, it must be long enough to protrude beyond the top of the wooden disc A when the latter is being used for taking direction with magnetic compass. This is to allow a second wooden disc (B) to turn on the stud without touching disc A. On the top of disc B a magnetic compass is sometimes placed as described later on.

(*To be continued.*)

A NEW COURSE OF PRACTICAL AND CONSTRUCTIVE WORK,

ARISING OUT OF AND COMBINED WITH THE ORDINARY SCHOOL SUBJECTS.

For Junior, Middle, and Upper Divisions of Primary Schools.

BY A. R. PICKLES, M.A., AND DALTON GRANGE.

IN recent years there has been a strong bias towards less bookishness and more practical and constructive work in the primary schools. The admirable kindergarten methods of the infant schools, and the various forms of manual work in the senior classes of the upper departments, have thoroughly demonstrated their educative value, and the Code of 1909 foreshadows the extension of these methods to the lower and middle classes of boys, girls, and mixed departments. Now many earnest teachers have looked with some apprehension on what they fear would be an addition to the already extensive curriculum—a piling of Ossa and Olympus on Pelion. Any scheme, therefore, which will provide adequate practical and constructive work arising out of, and combined with, the ordinary school subjects will be welcomed by thousands of teachers in schools of all grades and sizes.

The scheme we are now able to present is the result of an educational experiment which has been thoroughly tried and tested for the last five years. Every detail of the scheme has been fully worked out, and excisions, alterations, and additions have been made in the light of actual teaching experience. Perhaps the greatest merit of the scheme is that it can be applied to all sizes of school—from the small country school to the large town school. It is divided into *three parts*—junior, middle, and senior—each part containing at least twenty lessons, which may be increased to forty lessons, or to any number between twenty and forty, according to the size of school and arrangement of time-table. The essentials of the scheme lie in the three courses of twenty lessons each, and additional lessons are outlined where *intensive* teaching is possible or desirable.

The scheme embraces (*a*) Arithmetic, including substitution of letters for numbers, and Simple Mensuration; (*b*) Drawing—ruler, geometrical, and scale drawing; (*c*) Design and Tinting; (*d*) Paper and Cardboard Modelling; all embraced under the one time-table subject of *Practical Mathematics*. In the case of arithmetic, the scheme provides practical work to supplement the ordinary lessons, but does not replace or render unnecessary separate time-table provision for the teaching of and practice in the processes of arithmetic. It is claimed that the practical work can be much more conveniently taught in connection with drawing, design, etc., the whole forming a course which will lead up to the increasingly important subject of Practical Mathematics in continuation schools and technical classes. The actual school time-table (the school in which the course has been worked is a mixed school) is as follows (the part relating to this work only):—

One Period of Forty Minutes each afternoon.

	Boys.	*Girls.*
Mon.	Practical Mathematics.	Needlework.
Tues.	Freehand and Obj. Drawing.	Freehand and Obj. Drawing.
Wed.	Practical Mathematics.	Needlework.
Th.	Practical Mathematics.	Needlework.
Fri.	Brush Drawing.	Brush Drawing.

The above applies to the junior and middle classes—that is, to those corresponding to Standards I.–IV. In the upper classes the arrangement is varied somewhat, and longer lessons are taken, but the principle of balancing Practical Mathematics (boys) with Needlework (girls), and of taking Freehand and Object Drawing with Pencil and Brush for both boys and girls is retained.

COURSE I.

JUNIORS.

The cube: its faces and edges.
Lines, measurement, drawing. Inches and centimetres.
Measurement of actual objects.
The square: exercises on lines, perimeter, area, construction.
The plumb-line and spirit-level. Kinds of lines.
Half and quarter inches.
Designs on coloured paper based on the square.
Practical exercises in modelling in paper, based on square and cube.
Paper-folding: chair, table, footstool, screen, etc.
Square prism: rectangle, rhombus, perimeter, area, etc.
Substitution of letters for numbers in the various calculations.
Use of squared paper for plotting of simple lines—journey, distance, etc.
Paper modelling: square box, oblong box, sledge, basket, square table, soap box, etc.
Calculations and problems based on all drawing and modelling exercises.

Lesson 1.—The Cube: Its Faces and Edges.

[Note.—(*a*) Each pupil in the class is to be supplied with a cube of strong paper, cardboard, or wood. The cube should not be too large for the young pupils to handle with ease, and should have an edge measuring an exact number of inches. A 2-inch cube is recommended for the first lessons. A larger cube should be provided for the use of the teacher.

(*b*) The course should be worked out in a special drawing-book, as it is essential that the pupil should be able to refer to work already done, and make use of the conclusions arrived at.]

1. Place cube on desk. Number the top face a good-sized figure 1. Now number the face which is right in front of you 2. Turn the cube round from right to left, to bring *another* face in front.—Number this 3. Turn again.—Number 4. Once again.—Number 5. Once again. Which face is now opposite?—Number 2 again. How many side faces has the cube?—(4). Is there any face not yet numbered?—The bottom. Turn this up, and number it 6. Now write in your drawing-book how many faces a cube has.

2. How many faces have two cubes? three? four? etc.

3. Place teacher's cube on the desk. Ask a child directly opposite how many faces he can see without moving the cube. Now place it with one of the edges facing the child. How many faces can he see now? Build in front of the class a wall of small cubes (say three cubes high and four long). How many faces of any one cube can pupils see in the second row? (Other questions could be framed from this wall of cubes.)

4. Now direct pupils to place the cube on a page of the drawing-book, to hold it firmly in position with the left hand, and to trace carefully round the base of the cube (side 6) with the lead pencil. Then take away the cube. How many lines have you drawn? How many lines have two boys drawn? three? etc. Place the side numbered 1 on the drawing. Do the same with *all* the sides. (The pupils will no doubt discover that all the faces of the cube are equal in size.)

5. Provide each pupil with a sheet of gummed coloured paper and a pair of scissors. Place the cube on the gummed side of the paper, and repeat as in 4. Then direct pupils to cut out the portion marked with lead pencil, and fasten it in the drawing-book underneath the previous drawing. Again test each face of the cube on this coloured portion. Now ask the pupil to write what he has found out in 4 and 5 in his drawing-book.

6. Now direct pupil to take his cube in his hands, putting the thumb and first three fingers of one hand one across each of the four edges of one face, and the other thumb and fingers similarly across the four edges of the opposite face. Now how many edges are you touching?—(8.) How many edges are you *not* touching?—(4.) Then how many edges has the cube altogether?—(12.) Write in drawing-book how many edges a cube has.

Exercises on Lesson 1.

1. Find the sum of the faces of four cubes.
2. How many edges have three cubes?
3. Find the sum of the faces and the edges of a cube.
4. How many cubes are there in the wall of cubes?
5. How many faces in the cube? How many edges has each face? Then why not twenty-four edges?

How the Pupil's Page could be Arranged.

1. A cube has six faces.
2. When the cube is on the desk in front of me I can see two faces.
3. When the edge faces me I can see three faces.
4. If I build a cube into a wall I can see only one face.
5. All the faces of a cube are equal in size.
6. A cube has twelve edges.

1. There are twenty-four faces in four cubes.
2. There are thirty-six edges in three cubes.
3. The faces and edges of a cube add up to eighteen.
4. There are twelve cubes in the wall.
5. Each edge of a cube is the edge of two faces.

Lesson 2.—Measurement of Lines—Inches and Centimetres.

[Note.—(*a*) A ruler graduated in inches and centimetres is recommended, so that the ordinary measure of inches and the metric measure may be taken from the very commencement of these lessons in mathematics.

(*b*) After explaining the ruler to the class, the teacher should give numerous exercises in the actual measurement of lines. These lines at first should represent an exact number of inches or centimetres. As the great majority of the actual objects that could be placed before the class would not possess this desirable quality, the teacher should prepare some lines for these exercises. Reproduce on sheets of foolscap a sufficient number of copies of the lines for measurement (see below) to provide each pupil with one.]

1. Direct attention to the ruler, and the lines and spaces on it. Write the words "inch" and "inches" on the blackboard. Pupils write in books. Connect "inch" with the *space* on the ruler between the inch lines.

2. Place the ruler on the edge of your cube. How many spaces long is the edge? How many inches long is it? Repeat with the lines on the graphed sheet. Write down length.

Lines for Measurement.*

	Inches.
1.	3
2.	6
3.	1
4.	5
5.	4
6.	2

Some Exercises.

1. What is the sum of the lines 1 and 2? 2 and 5? 3 and 4? of all the lines, 1 to 6?
2. Write down the difference between the lengths of the lines 1 and 2, 2 and 3, etc.
3. From the sum of lines 1 and 4 take line 2.
4. Four lines each as long as 2 are placed end to end. What is their total length?
5. How many times as long as line 6 is line 2?

Look at the opposite edge of the ruler. Are these spaces greater than an inch, or less? Place this edge of your ruler on the edge of the cube. How many spaces long is it? Write the word "centimetre" on the blackboard, and also the abbreviated form "cm." Pupils write in books.

Lines for Measurement.

	Cm.
a	6
b	14
c	9
d	10
e	12
f	8
g	7
h	13
i	12
j	2
k	15

* These are here given half scale.

Some Exercises.

6. Measure and write down the lengths of the lines *a* to *k* in cm.
7. See Questions 1 to 5 above.

[In the drawing of lines, see that the pupils are taught to hold the ruler firmly with the left hand.]

8. Draw lines 1", 2", 3", etc.; 3 cm., 4 cm., 5 cm., etc.
9. Draw line 6. Add line 3 to the end. What is the length of the new line?
10. Draw a dotted line equal in length to *a*. Add a thick line to it, so as to make the whole line equal to *b*. What is the length of the thick part?
11. Draw a line in your book equal in length to *i*. Mark off as many parts as you can each equal to *j*.
12. Measure lines 5 and 6 in cm.
13. Draw a line 4 inches long. Now measure it with the centimetre edge of the ruler, and say which is the longer, 4 in. or 10 cm.

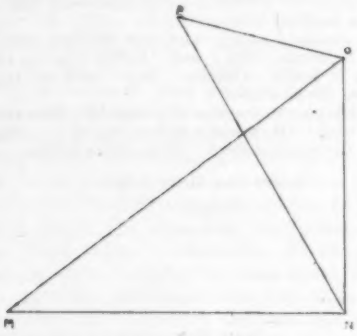
How the Pupil's Page could be Arranged.

1. Line 1 = 3 in.
   Line 2 = 6 in.
   Sum = 9 in.

9. Line 6. | Line 3. — 3 in.
10. ..... — 8 cm.
11. 2 cm. | 2 cm. | 2 cm | 2 cm. | 2 cm. | 2 cm. — 6 parts.
13. ——— 4 in. is longer.

Lesson 3.—Measurement of Lines—Inches.

[The following figure should be reproduced by the teacher in sufficient numbers to give each pupil one.]



1. Find the value in inches of—(*a*) MN + NO; (*b*) NO + OM; (*c*) OM + OP; (*d*) NO + OP; (*e*) NP + PO; (*f*) MO + NP.
2. Work the following: (*a*) OM − MN; (*b*) MO − NO; (*c*) NM − OP; (*d*) NO − OP.
3. What is the sum of—(*a*) MN, NO, OP? (*b*) NO, OP, PN? (*c*) NP, NM, MO? (*d*) OP, NM, NO?
4. Draw the line NM. Cut off a part equal in length to OP. How many times longer is the first than the second?
5. Draw a line equal in length to NO. Add the line OP to the end. Measure and write down the length of the new line.

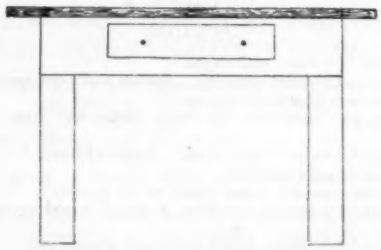
How the Pupil's Page could be Arranged.

1. MN + NO = 7 in. NO + OM = 8 in
2. OM − MN = 1 in. MO − NO = 2 in.
3. MN + NO + OP = 11 in. NO + OP + PN = 10 in.
4. ——— | ——— 2 times.
5. ——— | ——— 5 in.

Lesson 3 (*Continued*).—Measurement of Lines—Centimetres.

[The following figure should be reproduced by the teacher in sufficient numbers to give each pupil one. The actual object—doll's table—might be placed in front of the class.]

1. What is the length of the table leg?
2. Write down its width.
3. What is the distance between the legs?
4. Measure and write down the length of the table top.
5. Of the table drawer.
6. What is the distance between the two knobs of the table?



7. How far is it from the right-hand knob to the left-hand side of the table?
8. What is the distance round the drawer?
9. How much shorter is the drawer than the table top?
10. How far is it from the top of the table to the bottom of the leg?

How the Pupil's Page could be Arranged.

1. The table leg is 5 cm. long.
2. Its width is 1 cm.
3. The distance between the legs is 7 cm.
4. The table top is 11 cm. long.
5. The table drawer is 5 cm. long.
6. The distance between the two knobs is 3 cm.
7. From the right-hand knob to the left-hand side of the table is 6 cm.
8. It is 12 cm. round the drawer.
9. The drawer is 6 cm. shorter than the table top.
10. From the top of the table to the bottom of the leg is 7 cm.

Lesson 4.—Practical Measurement of Actual Objects.

[Note.—(*a*) The number of objects suitable for actual measurement by members of a junior class is limited, but there are some which should be useful. Actual measurement of real objects is the best training.

(*b*) The list is suggestive only. Many other objects could be chosen, according to the homes from which the pupils come, the industries of the district, etc.

(*c*) The objects in the following list have been chosen because (1) in some way they afford practice in measurement of an exact number of inches or centimetres; (2) they are easily obtainable in sufficient quantities to permit of each pupil in the class measuring the object.

(*d*) Preparation on the part of the teacher is needed, so that the pupil is not asked to measure unsuitable lines.]

Measure—

1. The length of a new lead pencil. (7 in.)
2. The length of a new penholder. (6 in.)
3. The length of a small manilla envelope. (6 in.)
4. The length of a sheet of writing-paper. (7 in.)
5. The distance across a halfpenny. (1 in.)
6. A matchbox. (Various measurements.)
7. The width of a stamp. (2 cm.) (Post-cards and envelopes that have passed through the post could be utilised.)
8. The length of selected lines of reading matter in the reading book.
9. The length and width of selected pictures in the reading book.
10. Models borrowed from other classes.
11. The length and width of back of reading book.
12. The width and length of pages and pictures on calendars.
13. The distance between certain selected lines in the exercise books and on foolscap paper.

Exercises.

1. What is the length of two lead pencils? of three?
2. A pencil is put to the end of a penholder. What is their total length?
3. Place a halfpenny between the pencil and the penholder. What is the length now?
4. Take away the pencil. What length remains?
5. How many halfpennies would you put side by side to stretch across this envelope?
6. Place two envelopes end to end. Write down their total length.
7. How much longer are two lead pencils than two envelopes?
8. What is the width of nine spaces on the writing-paper?
9. I have here five stamps side by side. Write down their total length.
10. What is the width of a sheet of foolscap?

FAR AND NEAR.

INTERESTING ITEMS FROM VARIOUS SOURCES.

The Schoolboy and the Miracle.

"REGINALD of Durham, a monk of the twelfth century, describes in the *Book of the Miracles of St. Cuthbert* a village school at Norham-on-Tweed, where some of the boys attended for love of learning, and others from fear of the rod. He says it was kept in the church of St. Cuthbert, according to the practice common enough in his time. One of the boys, called Haldane, considering how he might escape the rod for his laziness, stole the key of the church and threw it into a pool called Padduwell, 'which almost seemed a sea for its immense profundity,' conceiving that the school would thus be unable to meet. All attempts to break open the church door having failed, the master, much perturbed in spirit, retired for the night; but in a dream the saint appeared to him, and instructed him to proceed to the fishermen at Padduwell and 'buy at any price the first draught of their nets.' Next morning, on carrying out these instructions, he became the possessor of a huge salmon, which on examination was found to have in its gills the missing key. What the cunning Haldane received, the Latin Chronicler does not say. 'Nobody,' says Innes, 'can read that story without being satisfied that it was a parish school for the parish boys, one of whom, a tricky fellow, thought to get rid of the restraint by stealing the church key and throwing it into a deep pool of Tweed.'"—"*Secondary Education in Scotland*," *by John Strong, M.A.* (*Clarendon Press*).

* * *

The Vocation Teacher.

IN every high school there should be a vocation teacher, whose duties might be briefly outlined as follows: Before the opening of school every new pupil must have a private interview with the vocation teacher on the subject of his ideas for the future. Some have a pretty definite idea of what they want to do. If their talents agree with their desires, the vocation teacher gives them permission to elect the courses that will put them on the right track. If, as is so often the case, the new pupil has no idea of his wants or capabilities, the vocation teacher tries, by questioning and experiment, to assist the pupil in coming to some decision and getting upon the right track. When the actual school work is under way, the vocation teacher keeps in close touch with every pupil by means of continued personal interviews. His most important work would be the close following of every pupil's record, and the constant supervision of each one's activities.—*Atlantic Monthly.*

* * *

Physical Facts.

IN his evidence before the Inter-departmental Committee on Physical Deterioration, Dr. Eichholz says: "I have sought confirmation of my view with medical colleagues in public work—for example, public health, poor law, factory acts, education, and in private practice in poor areas, and I have also consulted large maternity charities, and have always been strengthened in this view—in no single case has it ever been asserted that ill-nourished or unhealthy babies are more frequent at the time of birth among the poor than among the rich, or that hereditary diseases affect the newborn of the rich and poor unequally. The poorest and most ill-nurtured women bring forth as hale and strong-looking babies as those in the very best conditions. In fact, it almost appears as though the unborn child fights strenuously for its own health at the expense of the mother, and arrives in the world with a full chance of living a normal physical existence."—*The World's Work.*

* * *

A Subject for Debate.

PRUSSIA and Germany hold a position altogether unique. They can claim that the wars they waged during the nineteenth century were waged for necessary, most worthy, and rational objects. Neither England nor France, Russia nor Austria, can make any such claim. The Prussian and German army can claim that it exists only for great and worthy national objects. When the world in general has reached this stage, universal peace is nigh. When wars are carried on only for worthy and rational objects, we have clearly entered on the higher plane from which war can be entirely eliminated. In what regards the supreme interests of the world's peace, Germany, therefore, has not much to learn from her neighbours, and she can teach them many lessons of incalculable value. She may justly claim that she has shown the way towards a real and practical solution of this mighty problem.—*Contemporary Review.*

A Specific against Fatigue.

SINCE all the fatigue substances known are acid in reaction, it would be readily inferred that the use of alkalies in some form or other would be advantageous. On this point we again resort to experiment, and find that a muscle contracting in an alkaline solution is capable of much more work than one in neutral solution. The injection of the extract of fatigued muscles into fresh animals produces all the symptoms of fatigue, and even death by apparent exhaustion if the dose is large enough. So far the results are in accord with experiments already mentioned, but we now go a step further and find that repeated injections of medium doses of this toxic extract of fatigued muscle develop an anti-toxin in the blood of the injected animal, and it is soon able to stand many times the fatal dose of the extract. This fatigue anti-toxin has been separated from the blood and administered to fatigued animals, with the result that they recover very much more quickly than usual. When given at the same time that the toxic extract of fatigued muscle is injected, the latter has no effect. This anti-toxin has also been put in the form of tablets and given to human beings, with the result that records of the contractions of some of their muscles prove them to be very much more resistant to fatigue than when the anti-toxin was not given. In some cases they were able to do nearly a hundred per cent. more work before exhaustion, and this without any apparent after-effect. Indeed, in the light of the rapid progress made in the last few years, it is not even too much to suppose that some day we may have a form of immunisation against fatigue that will be as effective as the present vaccination for smallpox.—*Harper's Magazine.*

* * *

Talking "Shop."

PERSONALLY, I believe that the best kind of talk is that unjustly described as "shop." When a man "talks shop," it means that he is speaking of matters concerning which he has some real knowledge. If you meet a soldier, schoolmaster, painter, or elephant-tamer, wouldn't you rather hear him on the subject of his profession—and most men are only too glad to talk "shop" when they realise that their hearers will not be bored—than listen to his opinion of ballooning or the Budget? Most kinds of "shop" are good; those of clerics, teachers, writers, and doctors being of a particular fascination. Schoolmasters (and schoolmistresses) talk the most delightful "shop;" they are so keen, their hearts are so thoroughly in their work. Literary men affect an omniscience which becomes quite diverting when you have ceased to take them seriously. And the real joy of "shop" is that it enables you to see life from so many points of view. Most of us want, not merely to understand, but actually to *be* for a time, a score of different persons. But the next best thing is to encourage all your friends to talk as much "shop" as they will.—*The Treasury.*

* * *

Eyes and no Eyes.

MR. C. W. LARNED, in the *North American Review*, recommends the reader to "endeavour to recall the details of physiognomy, of dress, of carriage, of habit, both of friends and of casual acquaintances, finally of passing strangers. From that pass to action and associations. Next, carry your range of visual acumen into Nature in your daily walks. Upon your return from your various excursions take a few moments for the preparation of a brief mental memoir and itinerary—develop your negative and file it. Presently your interest will be very much stimulated, and you will be considerably astonished not only at the enormous amount of significant matter that has hitherto wholly escaped you, but at your latent capacity to seize and retain it. Finally, you will discover that the old habit of blindsight has departed.

* * *

The Age of Pepsin.

ECONOMICALLY, we live in an age of electricity; morally, in an age of pepsin. A mania for predigestion has laid hold of our generation, and we have simply got to reckon with it. We began by pepsinising the instruction given in our schools. Why multiply illustrations? Are not here enough to show that the world is by degrees getting ready to lie abed all day and transact its business, from feeding the body to earning an income, by pressing a button or consulting a book? By-and-by will come a master mind which will invent an automatic reading apparatus, and a device for transmuting thought into force so as to do away with the need of even reaching for the button. The male citizen will then be able to buy his political conclusions already moulded, and have his vote cast for him by a patent polling machine; while for the mistress of the house will be

contrived a set of appliances for driving tacks without the aid of her hairbrush, and opening tins when her embroidery scissors are mislaid.—*The Atlantic Monthly.*

"WHAT reform would be most beneficial to the children?" The *Christian Commonwealth* has put this question to a number of workers in social movements, and has summarised the replies as follows in an excellent children's number:—

Compulsory feeding of school children	11
Medical treatment of school children	10
Prohibition of half-time	6
Abolition of street trading	4
Minority Report proposals	3
Improved education	3
Licensing reform	2
Provision of clothes	2
Endowment of motherhood	2
Housing reform	2
Women's suffrage	1
Employment for fathers	1
Technical instruction	1
Prohibition of pernicious literature	1

Chips of the Old Block.

THE first thing to realise about children is that they are separate individuals, not merely chips of the old block. Chips of the old block they are too, no doubt; but what parents sometimes forget is that they are separate persons, each with a life and destiny of its own. It is therefore quite possible not only that the child may not understand us, but that we may not understand the child. The individuality thus isolated in a child is not always good; sometimes it is bad. There can be, I presume, as many grades among children as among adults. I shall assume, what may be true, that all children who are given a decent chance in life, both by ancestry and by nurture, will respond to judicious treatment, and be a credit to their home and upbringing. For I think it more helpful to emphasise the essential goodness of human nature than its essential badness. There must be phenomena which have led theologians to formulate the doctrine of original sin; but there must be at least equal, and I think far greater, truth in the more authoritative statement applied to typical children, that "of such is the kingdom of heaven."—*Sir Oliver Lodge.*

True or False.

THE habit of constantly asking whether everything is *true* is an inappropriate habit; it means that the wrong mood is uppermost. Some things are better than true. You do not call a sunset or the Sistine Madonna or the Fifth Symphony "true." A cloud is not what it seems, and, going up to it, you find it merely a wet drizzle. A rainbow is in many ways deceptive. A mirage can be treated scientifically enough, but to the eye it is a phantasm. Even the image in a looking-glass is not really *there*. Children must learn that things are not what they seem, and that works of imagination and beauty have a truth of their own which can be felt, but not stated. They will know this instinctively; they will not require to be taught it, if they have not been first taught wrong. Wrong teaching is the deadly thing, the thing to avoid. Poetry is the wholesome antidote for any exaggeration on the scientific side. "True to Nature" a great poem—yes, any reasonable poem—must be. True to historical fact, certainly not. To take a simple case: Enoch Arden need not have lived. Macbeth is Macbeth without any aid from Scottish history; Robinson Crusoe is independent of Alexander Selkirk; Hamlet and Othello are alive in their own magnificent way. It is the scholar's way, but it is also the unsophisticated child's way. So are Red Riding Hood and Jack the Giant Killer, and Don Quixote, and all the other heroes.—*Sir Oliver Lodge.*

Corpus sanum.

IT is surely time to emphasise the fact that a fine and complete type of physical culture is wanted for every child as the first condition of his being fit to receive any other kind of education whatsoever. I do not think this has yet been attempted; nor has such an attempt even been conceived of generally as a possible and desirable thing. So the first thing we have to do is to picture the child as he is, and also the environment in which he is reared. We have to think of his home, of his sleeping-room, of his diet, of his routine of life in street and playground, living-room, and school. And, above all, we have to look at him as he is—the result of these and other factors in life. It may be that he is in very little need of formal drill, and even that formal drill of any kind would be injurious to him. It may be that manual training, as such, is not the kind of thing of which he stands in need. In saying this I do not minimise the importance of handwork. To detach ourselves from latent memories seems to be our first duty now in dealing with the young. For habit has led us far astray, and has even drawn a veil over our eyes.—*Margaret Macmillan.*

Guilds for Infants.

WHY should we not plan out a scheme of guilds for babies under control of the State, and with doctors and nurses paid by the national income—these officers to be attached to each body of watchers over the little ones, dividing the whole country into so many boards of infant health, and bringing to bear on all families alike, rich or poor, the wholesome care, advice, and medical knowledge needed? For the rich mothers are, in their own way, quite as criminal towards the babes as the poor ones are, only the wealth and comfort of the well-to-do save the little ones from dying in so ghastly a proportion as the children in crowded centres perish. Such guilds would quicken social legislation, and—perhaps better—see that existing laws are not allowed to become dormant. They would also be effective missionaries of the true laws of infant feeding and hygiene. This combination of public officials with willing volunteers would secure permanence, and win also—a much more important matter—the goodwill and the affection of the hard-pressed women throughout the country. And the volunteers, going in and out, will surely find a big reward in the little children themselves; they will also have the joy of seeing the creation of a warmer and more happy and reasonable home life. A babe is a nuisance or a blessing, as it may be; he will unconsciously answer with baby smiles to one's loving care, or he may, ill-handled, make the tiny house unbearable by his yells. Even the most jealous mother will recognise that the guild is no meddling affair of busybodies; she will not feel as she naturally feels when a fine lady comes in and bids her clean her steps, or go to church, or otherwise obey a superior.—*Dean Kitchin.*

Children as Christians.

ONE consideration alone ought to warn us of the danger of aiming at the "Christianising" of childhood except in a very loose and vague sense. Christianity stands at the end of a very long process of religious development in the history of the human race. It is at least the highest point reached by mankind in religion. It is, to say the least of it, a mature type of religious life. To it mankind has struggled through Animism, Polytheism, Henotheism, and other stages of religious faith. Now the psychological doctrine that every individual child naturally reproduces in miniature all the chief stages of culture through which the race has ascended may not be true in all respects, but it is so far the most suggestive theory we have found for the explanation of the general lines upon which the growth of the child proceeds. It has a sufficient basis in the elementary facts about child-life to warn us against prematurely forcing the pace of the child's religious development. We must not pitch the level of our religious instruction too high, and we must not demand too much from the child.—*Rev. J. Morgan Jones.*

The Religion of Childhood.

TRUE worship of God can be instilled into children in the following manner:—

"We all know," I would say to them, "that we must not offend, not abuse, not condemn any one, but must be kind to all, wish everybody well, and love everybody; and that if we do so it will be well for others and for ourselves. But still we often condemn, scold, and offend others, and wish well only to ourselves, and love only those that love us; and when we do that it is not well either for others or for ourselves."

"Why is it so?"

"It is so because each of us lives with soul and body. The soul wants nothing for itself alone, but desires the good of all and of everything in the world, and loves everybody, while our body desires only its own good and loves itself alone. So that the more you live for your soul and the less for your body the better it will be for others to live, and for you too."

"What are we to do to live more for our soul and less for our body?"

"To live so, we must understand, first of all, that our soul is the Spirit of God in man and is the same in all people, and then we must get into the habit of doing what the soul, and not the body, wishes."—*Count Tolstoy.*

AGRICULTURAL EDUCATION.

A SCHEME OF WORK FOR RURAL SCHOOLS.

BY W. FRANCIS RANKINE.

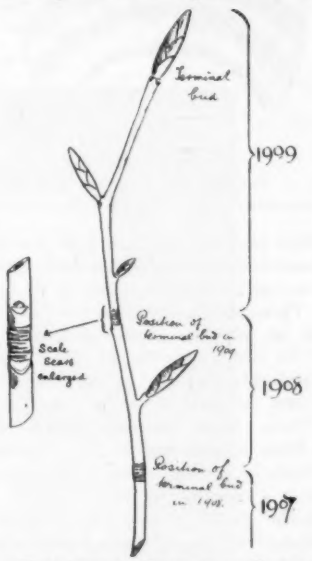
Lessons on Timber Trees.

SURVEYED generally, forestry in our islands is not a serious industry, and probably in the face of the residential development of land it will never attain to any great proportions; yet, despite these facts, the cultivation of trees will ever remain inseparable from agricultural industry, and thus intelligent treatment in this direction will always be necessary. There are few rural vocations which require so much intelligence and thought as that of the woodman, whose life is spent among trees, and whose knowledge of our commonest trees is as interesting as it is wide. From the farmer's point of view, the tree is only considered just so far as it is useful for sheltering beasts or for forming hedges, while the country boy is chiefly concerned with trees in their connection with the nesting sites of birds. Yet more immediate to the teacher's interest is the knowledge which tree study imparts to the school gardener, for it must be remembered that no scheme of school gardening is complete which does not embrace the cultivation of fruit. From the consideration of forest trees may be gleaned many of the rules necessary to the correct treatment of fruit. The following outlines suggest the scope and method of this work:—

Tree Buds: Their Structure, Arrangement, and Development.

The bud as the vegetative point of the tree suggests itself as the most convenient introduction to the study of trees. Many lessons may be based on them, varying with the point of view from which the bud is regarded. Most of the work will fall in the nature study lessons. An attempt should be made to inspect as many species as possible, for then the distinctive features of buds may be compared and contrasted. With this aim in view careful diagrams should be prepared of all the specimens observed. Careful attention should be directed to the size, shape, colour, and setting of the bud on the twig. These external features are subsequently very useful in the recognition of trees during the winter. Following these records, sections, transverse and longitudinal, should be prepared. These reveal the arrangement of the embryo leaves within the bud scales. Diagrams of the sections should be recorded side by side with the sketches of the buds. When this comparative study is complete, the class will be in possession of much data which should be entered in tabular form, in order to emphasise the distinctive feature of each kind of bud. Particular attention should be given to the function of the bud scale, by which the successful perennation of trees is made possible. These vary in colour, shape, number, and arrangement with each kind of tree, and therefore they are of great use in determining the tree. It should also be noted that the scales fall from the buds when their mission is achieved, and that the scars left on the twig are, as pointed out below, of great importance in determining the age of wood.

The arrangement of buds on the twig is the next consideration. Some are placed oppositely, others alternately, and others, again, spirally. This is a further aid in recognising trees. But beyond this the arrangement of buds leads to the noting of tree shapes, for upon the position of the buds depends primarily the habit of growth of the tree. The three types are easily identified among the numerous trees that flourish in country districts. Well-developed twigs should be collected and classified. A coat of varnish will preserve them for a long time. The development of buds is the next point to be observed. In the case of a "wood bud" a twig is developed, and this is generally referred to as "new wood." Fruit or blossom buds do not develop into twigs or branches. Thus it is necessary to be able to distinguish one from the other Fruit buds are generally larger than the wood buds on the same tree, and usually they are set closer to the twig. Observation of trees in their habitat will show how the bud arrangement influences branch extension. It will be found that, generally, in the alternate class extension takes place in one plane; in the opposites



THE ANNUAL GROWTH OF TREES.
A beech twig showing the scars left by the terminal bud scales.

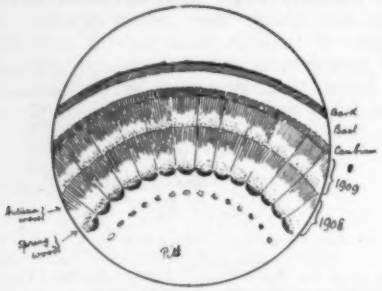
growth goes on in two planes; and in the spirals in more than two—usually three, but varying with the spiral. The hazel, ash, and oak respectively are good instances of these habits, and consequently typical specimens of these trees should be inspected—preferably when they are leafless.

The Annual Growth of Trees.

A close examination of a tree twig reveals the amount of growth made year by year. This is more apparent in some species than in others, and is usually more easily determined in young trees than in those of longer standing. Generally, the wood developed in the last season of growth is easily distinguished by its light colour as compared with that of the older wood. At this season of the year this fact is very noticeable in the woodlands, where the young twigs impart a distinctive colour haze to the trees. Thus young lime twigs are orange red, and sallows have yellowish new wood. This colour sign, however, only indicates the growth made in the last season. The index of growth is found in the scale-scars of the successive terminal buds. These, as in the case of the horse-chestnut, are easily traced. In species which have small bud scales the scars are not so easily seen. However, much

interesting work is possible here. The amount of growth can be recorded from year to year, and the annual rate of development may be compared in different subjects, and a fair estimate of the yearly growth of trees may be formulated.

On the fruit plot in the school garden this study gains added interest, since here the knife is resorted to in order to lead the tree into a desired shape. This regulation of growth, known technically as pruning, is ever a fascinating operation to the young gardener.



SECTION OF AN ELDER TWIG BENEATH THE MICROSCOPE.
Showing annular rings, medullary rays, and cambium.

However, before he can be trusted to the work, some amount of knowledge of individual fruit trees is desirable. The bearing habit of the tree to be pruned must be known. Throughout the practice the objects of pruning must be kept in mind—namely (1) to shape the tree, (2) to direct growth so that fruit may be exposed to sunlight, and (3) to regulate the development of the tree so that wood is not formed at the expense of fruit. Here the knowledge gained from the study of buds, as outlined at the beginning of this paper, is extremely useful, since it has been learned that the bud is a director of growth. The twig must be cut so that the growth is directed outwards—namely, the tree is pruned to an outward pointing bud, which necessarily must be a wood bud. In the case of the apple, which generally bears its fruit on old wood, the new wood is cut.

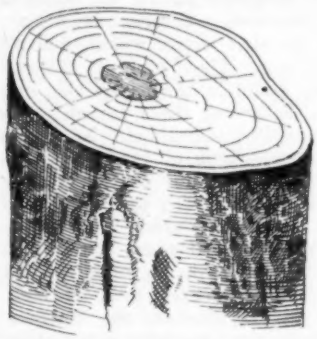
Growth as revealed by Annular Rings.

The growth of wood, as shown in section, opens up some of the most interesting lessons in connection with our subject. Year by year the tree grows higher, and its stems perceptibly thicken. Each year witnesses the addition of material to its substance. The bud scale scars afford a means of determining the amount of linear extension, and the annular rings as shown in section of timber indicate the yearly development of wood.

In examining sections of twigs a lens is indispensable, and for the examination of some of the tissues a low-power microscope is necessary. However, much interesting investigation is possible with the lens alone. Obtain several twigs of different ages—say, one, two, three, and four year old wood. From these prepare transverse sections, taking care to make clean cuts, so that the structure of the specimen is not hidden. In new wood it is easily seen that only one ring of wood tissue is distinguishable, while in others the number of rings correspond with the number of years the twig has been growing. The accompanying diagram shows a section of a two-year-old elder twig as seen under a one-inch objective. Its structure is typical of wood sections in general. In the centre is the pith or medulla; immediately outside this is the first-year wood, outside which is the second year's ring. Against this is the cambium layer, which is the region of active growth. Between this and the bark is the bast cylinder. Our interest, however, is directed to the annular rings. There is a distinctive line between one layer and the next. This is due to the difference between the wood which is formed in spring and that which develops in autumn. The spring wood is porous, light in colour, and soft; while the autumn layer is usually close in texture, dark in tint, and hard. In sections of the Spanish chestnut the porous spring wood is very noticeable. In some specimens the distinction is hardly discernible to the unaided eye. Sections of many different kinds of twigs should be made, and sketches of them prepared. Where the teacher is master of the art of micro-photography, a most valuable series of records may be obtained.

In sections of tree trunks or thick branches many rings are seen, and it will be noticed that the centre wood is harder and generally darker in colour than the outside wood. The former is called *heart-wood*, and yields the most serviceable timber. The outside wood is *sap-wood* or *splint-wood*, which, from the builder's point of view, is of secondary value. In hollow trees the heart-wood has disappeared, and the fact that many such trees still flourish proves that the sap-wood is sufficient channel for the supply of the tree system. Heart-wood does not contain living matter.

In the section, and also in the accompanying diagram, lines are seen radiating from the centre or medulla. These are the *medullary rays*, which are built up year by year by the cambium layer. Some of these rays connect the *cambium* with the *medulla*; others only go a part of the way. By means of specimens mounted from shavings it is possible to investigate still further the structure and arrangement of wood tissues. The extent to which this study may be taken will depend upon the botanical attainments of the teacher.



SECTION OF AN APPLE-TREE TRUNK.
Showing heart-wood (shaded), sap-wood, and annular rings.

It now remains to study the commonest of our forest and hedge-side trees in their habitats. The data obtained from these observations should be connected with the foregoing work. Notes on the height and shapes of the trees selected for observation should be made, and where the camera is available a series of photographs should be prepared to show each tree in its winter state and summer garb. The study in this direction opens up a wealth of observational work which will suggest itself to the teacher. The study will not be complete without the noting of the utility of trees.

Our Art and Handwork Section.

OLD ENGLISH COLOUR PRINTS.

BY W. E. SPARKES.

The Dainty Art.

SOME art is pleasant but not great. It may even be weak so far as technical knowledge goes, and yet it may fill a warm corner in our hearts. Old English colour prints are a case in point. I suppose association plays a great part in this. We look at these dainty pictures hanging in old curiosity shops, and their colours, mellowed by age, bring a crowd of thoughts to the mind. We begin to speculate where once they hung on a Georgian wall, and see in them a fit accompaniment to graceful furniture. About the room are Sheraton or Hepplewhite chairs, admirably proportioned, slender, with tapering legs, the backs carved into shell-forms or wheat-ears, and, if tapestried, then ornamented in soft silks blending delightfully. We hear again the quiet spinet, and see in imagination a quaintly dressed company sipping China tea out of flimsy cups. The talk is of "elegance" and "taste." There are memories of Bath and Cheltenham breaking in along the current of small talk; and the perils of the road from highwaymen are mixed up with the last scandal of the town.

"Morning" (Wheatley. Gillbank).

To such a scene nothing could be more appropriate than the ornaments on the walls. Slenderly carved festoons run above the fireplace and depend on the jambs of the door; miniatures in oval frames hang in the corners; the latest mezzotints from Sir Joshua Reynolds'

or Romney's portraits have an honoured place; the needlework pictures so dear to the age—Abraham sacrificing Isaac, or Phyllis and Corydon at their feast of herbs—add a touch of brightness to the sober-coloured walls; and here and there a tinted print by Bartolozzi looks curiously down on the company.

One would think there was no harshness in the world. The men take snuff with an air, the women make great play with their fans. All alike talk soft sentimentalities, and aim at a mild philosophy. Cut off from the world by the walls of their elegantly proportioned rooms, they seem to pass an inane life in discussing little things.

It comes as a rude shock to turn the thoughts for a moment to what writers and artists alike have revealed of the real, stirring life out of doors. Hogarth's prints (such as his "Gin Alley") are a strong antidote to mawkishness; in him and many others we see a totally different world. We stand by his side in Leicester Square at the door of his house; we see his shrewd eyes twinkling as they watch the humorous and boisterous incidents, the affectations and the brutalities, passing as a continual show. With these prints to guide us—to say nothing of Smollett and Fielding's full-blooded novels—we form an opinion little flattering to the times. The simperings and the inanities of the drawing-room fill a very small corner on the canvas. Gradually it is forced upon us that these people were very much alive. They had not yet reached the modern pose, which compels the well-bred to keep their feelings strictly under control. There is old Dr. Johnson thundering down all opposition even in the politest circles; he walks down Fleet Street superstitiously touching every post between Ludgate Hill and Temple Bar, quite careless of the quizzical eyeglasses raised to follow the lumbering gait of the "polite Hottentot," as the cynical Lord Chesterfield dubbed him, though in a famous letter the doctor gave an effective reply to that clever if unscrupulous nobleman; and he blubbers like a schoolboy as he reads Goldsmith's *Vicar of Wakefield* in manuscript.

Imagine, too, the young ladies dissolved in tears as they read *Clarissa Harlowe*, leaving an after generation amazed at the skill with which Richardson, the podgy printer, knew how to play on Georgian sensibilities.

Fighting, noise, dirt, drunkenness, and dissipation in the streets; rowdy crowds at the theatre; press-gangs hitting peaceful youths on the head, and dragging them insensible to the jolly-boats from the man-o'-war lying off Greenwich; hawkers crying their wares raucously and so unintelligibly that, as Addison had said a few years before, London appears "a distracted city to foreigners, who do not comprehend the meaning of such enormous outcries"—the vendors having "that idle accomplishment which they all aim at, of crying so as not to be understood."

Those were the days of Italian operas and Italian dancers—how charmingly they pirouette on stilt-like legs, and not without much smirking, in the mezzotints of the day. The players, too, had their fine art curiously confounded with a disregard for historical fitness, so that you would see "Julius Cæsar" in knee-breeches, and done to death by senators in bag-wigs.

It was indeed an age of contrarieties: roughness and brutality on the one hand, and an uncontrolled habit of letting their feelings show in all classes of society; and, on the other hand, an artificial, sentimental pose, and a regard for taste even in their frivolous life at the fashionable watering-places, and reflected in their dainty furniture and coloured prints.

The Fashion came from France.

I suppose there is little doubt but that France set the fashion in matters of taste in those days; and this is especially true of prints and pictures. There is just now a rage for collecting these French pictures. It is difficult to imagine anything more dainty and at the same time more empty and devoid of feeling. That fine artist, Watteau, had drawn in magnificent style ladies and gentlemen in silks and satins passing their time in country *fêtes*, where, it is true, Nature was either kept at bay or clipped down to its surroundings. Here were marble seats; a stone cupid with a poised butterfly on his finger looked down on the well-groomed crowd sitting on the grass quite regardless of their expensive frocks; or a cynical Pan sneered from his marble pillar at posing mortals playing at courting; while the trees, painted in theatrical blue-green, exquisitely harmonising with the silk dresses, completed an artificial but gay scene.

But Watteau painted thus only because fashion demanded it. You should study his magnificent drawings in the British Museum; you would discover there a very serious artist masquerading for profit, "goring his own thoughts, and selling cheap what is most dear"—that is to say, his own deeper nature.

After him came a crowd of artists in France, without his skill, absolutely without his feeling—superficial and tricky. Heavens! what grace, what frivolity! There are visits paid by fashionable ladies to other fashionable ladies, all finely dressed, all posing for effect, and all equally insincere. Here and there an artist breaks through the routine and draws something with a touch of real human feeling, but that is rare.

This was before the French Revolution. But there are records without number of the brutality, the coarseness, and the despair of the starving crowds, who looked grimly through the park gates at the rich disporting themselves as shepherds and nymphs. The storm was rapidly gathering; but before it broke it would seem as though the rumblings of the discontented poor made themselves heard even in the fashionable salons. Perhaps inspired by pity in the sympathetic few, prints dealing with homely life began to show in the shops of Paris; and the idlers in the Palais Royal began to take a languid interest in peasants returning from the fields or in poor children at their play.

But sentimentality had eaten into the tissues of French art, with a curious result. The artists had so long been engaged in drawing elegant men and women that the very country labourers were regular Turveydrops and professors of deportment. There was no roughness or dirt. Evidently one had merely to carry a spade to the field—a nicely swept and tidy field—and after toying with it for a few hours return to an admiring family, dressed all in their best, daintily featured, and with their hands as supple as a musician's. Look, for instance, at the latest product, Greuze. Ah! those girls weeping over dead sparrows, or looking with tearful eyes at nothing in particular, but perfectly conscious that tears—a watery bathos—suit the public! Why, even to-day, a century and a quarter after the artist's death, autotypes after Greuze sell "like hot cakes."

The Fashion takes Root in England.

I am trying to trace the origins and the spirit of the old English colour prints—that is to say, the prints in which ideal people were represented. Side by side with these were the colour prints after Reynolds', Romney's, and Gainsborough's portraits, or Morland's rustic scenes—a very different world. There you have really fine art. The engravers were splendidly equipped; and Sir Joshua's exclamation, "I shall be immortalised by that man!" aptly indicates in what esteem they were held. Morland was engraved superbly by William Ward, and his prints, "St. James's Park" and "A Tea-Party," and many another, must continue to grow in favour. They are sincere, utterly free from mawkishness, and finely artistic in drawing as well as in engraving.

But there are other old English prints by much less gifted men. Yet these, as I said above, have a delight from association, and their mellowed tints blend like the colours in an old and faded Chinese silk.

Wheatley was a man who enjoyed a tremendous vogue. Like so many other British artists at the time, while taking his cue from the French prints which had found their way from the Continent in such quantities, Wheatley's stolid English nature saved him from sheer inanity. His people are well-grown, healthy, and handsome after a fashion; they carry themselves gracefully, but not with that insufferable regard for pose which makes the French prints so trying. Look, for instance, at his "Morning" and "Evening." Were there ever such spick-and-span cottagers, all carefully dressed, and without a rag or a stain? See the dancing shoes worn by the women, who are evidently well-to-do ladies playing a part, just as the French court had aped at Versailles a simple country life, and were pleased to call themselves and each other by fanciful names. So these English peasants in Wheatley's prints are well-conditioned, well-dressed, and without a trace of care or hardness. It is pleasant to think that if the poor are not like this, it would be well if they were. But what feeling or depth is there in these pleasant prints? None whatever. Wheatley drew a series of "London Cries" all after this fashion. Reduced noblemen mend chairs in the public streets; duchesses and fine ladies in disguise hawk milk and strawberries. How different from the modern outlook. Imagine Millet's toil-worn labourers or Mr. George Clausen's reapers beside these easy-going and prosperous Londoners.

These prints show, too, how every movement marks itself down in the arts. In Wheatley's day there was a run on Greek and Roman ideals. The buildings, the ornaments, are eloquent; there was a rage for collecting classical sculpture. The results are plainly seen in even so slight a thing as an English colour print. It is not difficult to trace in Wheatley's "Morning" and "Evening" the straight, Greek classical nose; the father returning from work recalls in his attitude the Apollo Belvedere; and in the two women in this picture there is more than a suspicion of Greek girls drawn on an ancient vase.

We shall look then for prettiness, for the sugary-sweet, the slightly sentimental, but by no means for the severe or even sincere, in most old English prints. The colours will charm us, and the drawing, if not strong, will appear soft and pleasant.

In the attempt to place ourselves in the past and see through Georgian eyes it becomes evident that we must try to forget later art—a difficult task—if we are to judge these prints aright. All great art has unmistakable signs; and however distant in time and space from each other, these abiding works stand out like towers in a crowded city. But though Wheatley's pictures can by no means be counted fine, they have an interest in revealing the ideals which stirred our forefathers, to whom, doubtless, Millet's peasants would have appeared ridiculous. Fashions and environment are too strong to be altogether resisted; and, as a proof, we are to imagine what reception an artist who revived Wheatley's style would meet with in these days.

How the Foundations for the Colour Print were laid.

Engravings were very popular in the late eighteenth century. The finest contemporary portraits were admirably multiplied in this way; they had a ready sale in days before photography and cheap process had made prints too common. That is why these engravings, quite apart from their subjects, have a deep interest nowadays. Wood-engraving is almost dead; mezzotint and stipple (I shall explain these later on) are next to gone. The delight which comes from tracing a man's craftsmanship has no meaning to most people.

For these old English colour prints had first to be well engraved. It was almost by accident that printing in colour came about. Of course, in early days, artists had frequently tinted engravings for their own pleasure, or, frequently, to hide defects in the print.

The plates were generally copper. There was one principle common to them all—namely, that little grooves, lines, dots, or what not, had first to be made in the copper, and then those hollows, and those hollows only, were to be filled with ink. If a sheet of damp paper is placed over such a plate, and then both plate and paper passed under a press, the ink will mark itself down on the paper.

Old English colour prints were either etchings, or mezzotints, or stipple engravings, or aquatints coloured in appropriate tints; and all these various types called for immense skill on the engraver's part. Not only that, but the best man added many delightful touches to the plate, for no original man can fail to express himself even in copying another's picture.

Etchings were chiefly used for book illustration, and were not largely used for colour prints.

Mezzotints, aquatints, and stipple engravings were very largely employed.

To understand the differences between the various kinds of colour prints, one must appreciate the effects to be obtained by the process employed. You will sometimes see an old colour print in which the colours are very faint, and you may think this due to time, whereas the reason is to be found in the engraving. You may think this strange. How can the engraving modify the colour? Let us see how the different processes affect the copper plate, and we shall be able, with a magnifying glass in our hand, to account easily for differences in colour, and why some plates are "full" and others tender and evanescent.

Mezzotint.—This is peculiarly "the British art." There have been no engravers in the world like the English and Irish mezzotinters who worked a century and a half ago.

The first thing to do was to take a tool called the "rocker," armed with sharp teeth very close together.

This was held upright on the copper and rocked across the plate with great force. The teeth dug tiny holes in the plate. By "rocking" the plate in this way, and in all directions, the whole surface was covered with an immense number of these holes, the *edge of each hole having a "burr" or roughness* caused by the teeth of the rocker tearing up the copper. If you carried your finger across such a plate in any direction, you would feel a slight roughness.

If printing ink were then spread all over such a plate, it would, of course, give an intensely black impression without a spark of light. But suppose you took a sharp scraper and scraped off some of the "burr" in parts, and then covered the whole plate with ink. Then if you wiped the plate with a rag, the ink would be swept away in those parts from which the burr had been removed, while in all other parts it would print dead black. Now it is possible to scrape away a little burr or a great deal as you please, and so you could get the softest shades ranging from white to dense blackness.

Imagine an artist about to copy a portrait by Reynolds. He would take his "rocked" plate, and after drawing on this the outline, would proceed with his scraper to get rid of the burr, a little here, more there. The tenderest tints could be secured. If you were an artist as well as an engraver, you would add beauties according to your lights. If your spirit were to return to Christie's saleroom in this year of grace, you might have the satisfaction of seeing one of your plates (sold originally in your lifetime for fifteen shillings) knocked down to a collector for a thousand guineas. That at least would show you how delightful a later age finds your exquisite workmanship.

"Evening" (Wheatley. Gillbank).

Mezzotints soon wore down in the press; the burr was gradually smashed flat. All the delicacies disappeared; the plate became a mere shadow. But its possibilities were by no means exhausted; for in its worn-down state it is better for the colour printer, as I shall show soon.

(To be continued.)

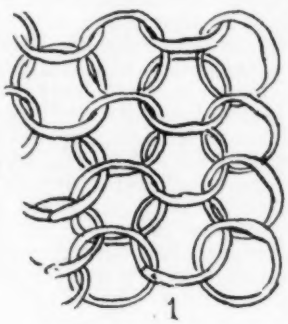
THE HISTORY LESSON AND DRAWING.

BY W. H. ELGAR.

VI.—ARMOUR (Part I.).

IF drawing is speedily to take the position it deserves in general education, its practical application to other studies must be made very clear to those who have their direction. Especially is this true of secondary and higher education. Drawing instruction in the schools of the middle classes has too long been almost confined to preliminary studies which lead nowhere, or at the best to mere picture making. Of course brilliant exceptions exist, but the remark applies to the majority.

In many of our great educational institutions students may be found who will travel miles to get a rubbing of an effigy or an inscription, or take a photograph of some



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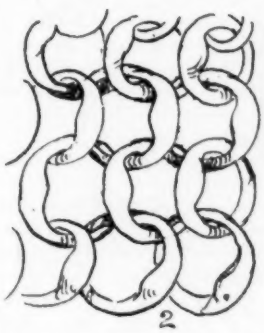

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historic place or building. On the other hand, in the primary schools of our country, few, if any, pupils, or even teachers, trouble to much more than glance at these priceless records of costume and armour; yet many of them are trying to apply their drawing power to the recording of natural objects and to manual work.

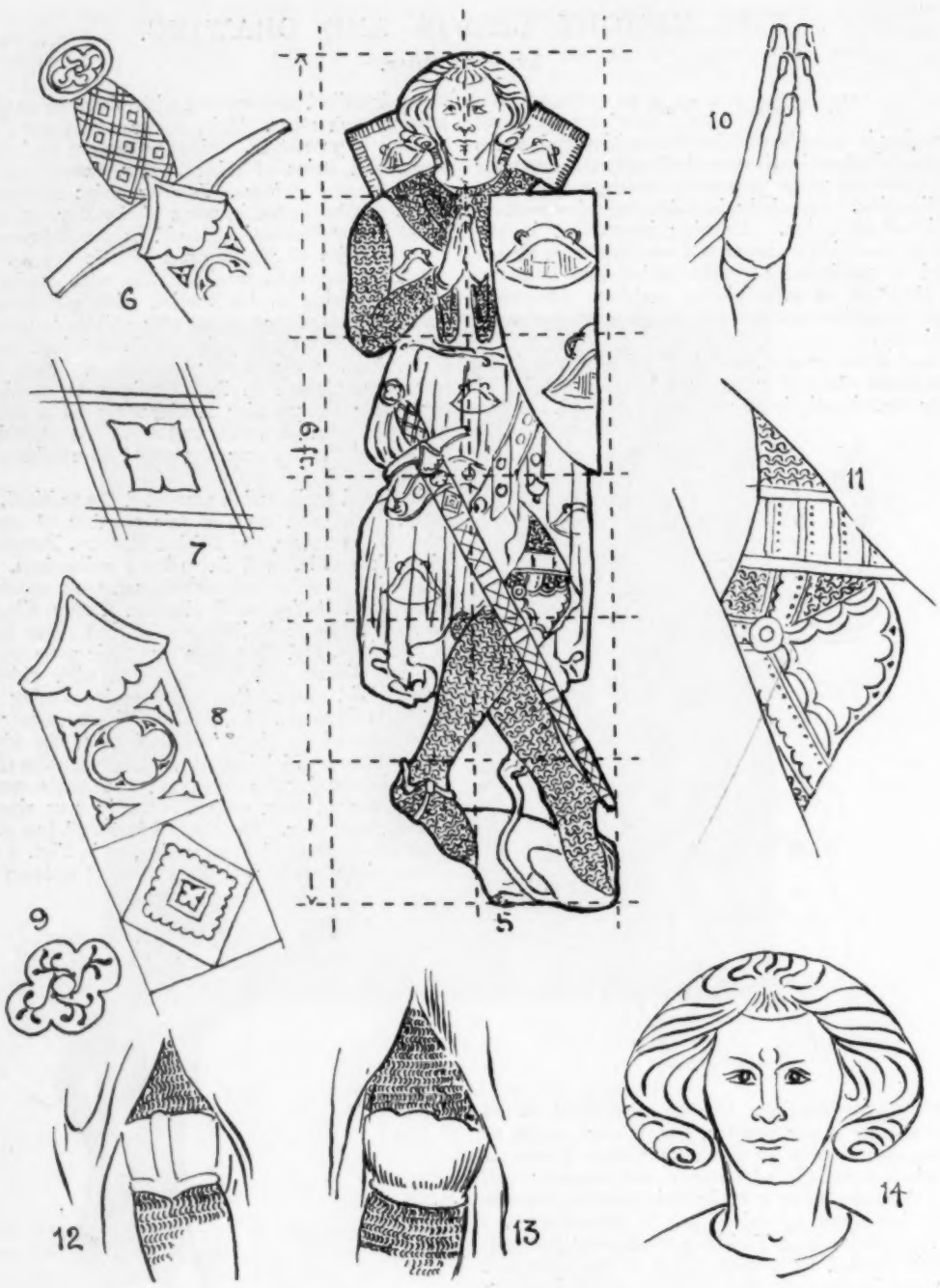
The Lancastrian and Yorkist periods may, perhaps, be best illustrated by a short study of the arms and armour used in the great wars of those eventful eighty-five years; and to do this intelligently, previous conditions must be considered. At the same time it will be just as well to treat briefly the subsequent changes, and so save all but the barest references to armour in succeeding papers.

Our article on the Norman period contained a drawing of a figure of a Norman knight clothed in the hauberk, conical headpiece, etc., and holding the long-pointed shield of the time of the Conquest. The hauberk there described was covered with plates of metal overlapping each other. This, however, was not the only method of protection. Rings were sewn on in various ways, and strips of thick leather, as well as rivets, added to the defence. Leather strips arranged like trellis can be traced in parts of the Bayeux tapestry. What better illustrations could be put before children than a series of photographs of this famous work? Actual photographs would enable such details as we are considering to be studied with confidence, and there is no earthly reason why children's note-books should not contain graphic records of things like these taken from really good photographs. Then the inscriptions, though in Latin, might be studied and explained; the peculiar modifications as to scale and general treatment consequent upon the material and purpose of the tapestry also could be considered with profit.

Of ringed mail, which succeeded the trellised, imbricated, or macled coat, a fair number of examples exist at the Tower, the British Museum, Dover Castle, Warwick Castle, and in private collections. It is interesting to note that several such coats of mail were taken from bodies at Omdurman during Kitchener's campaign. There is little doubt that these belonged to crusaders, and that they owe their preservation to the dry climate and to the esteem with which their owners held them. One of these is hanging in the Westgate Museum, Canterbury. Great variety exists in the size of the rings, the sections of the wire, and in the methods of joining them. There are also different ways of arranging the rings, and some parts were more closely packed than others. Usually four rings pass through each ring. Sketches of just sufficient rings to show the method of construction, as in Figs. 1 and 2, are certainly not beyond the powers of children or the

FIG. 15.

bounds of reason. Fig. 15 is of a completely mailed knight of the thirteenth century, with coif (head and neck cover), mufflers, and leg and feet mail (chaussons and chausses). Under the mail coat was worn a tunic



called a *haqueton* or *gambison*. It should be noted that the sword is worn in a waist belt, and not suspended from the shoulder, as in the time of the Conqueror, and that the conical headpiece is replaced by a cylindrical helm, having a protection for the nose and large cheek pieces. This form is decidedly English. A surcoat of cloth, seen in our illustration, proved invaluable during inclement weather. The effect of a number of warriors so equipped must have been very fine—faintly suggested, perhaps, by the sequin-covered actors of the modern stage; and it is no wonder that artists have loved to paint pictures illustrating this period.

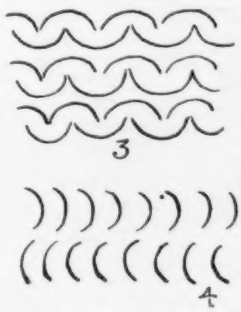
No sooner had the body been thus completely clothed in mail than, owing to improvements in weapons of attack, it became necessary to protect certain parts, as the knees, elbows, and armpits, with plates of metal.

This covering process went on until the whole body was encased in plate armour, the mail being retained in parts until a very late period, and in some cases never dispensed with.

To trace this gradual process would be most interesting, and it might be compared to the incessant struggle between the makers of battleship armour-plate and the designers of guns. The effigies of Pembroke and others in the Temple Church, London, exhibit knee defences (Fig. 12), as does that of Aymer de Valence at Westminster (Fig. 13). Notes like these could be made in a few minutes by pupils of average capacity.

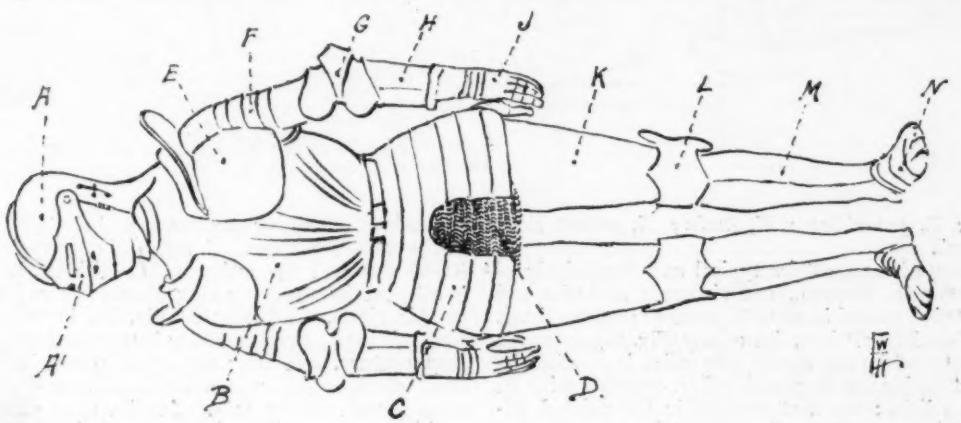
The objects of study already referred to in this paper are accessible to comparatively few, but hundreds of our village churches contain brasses representing the costume and armour of the Middle Ages, records of the highest authority and of local interest. At the present time it is well known that many commence the study of history with that of the locality in which the school is situated. What better illustrations for the schoolroom could be imagined than rubbings of brasses from churches in the district? No very great skill is required in this work, and the materials are cheap and easily obtained. A roll of white ceiling or lining paper from a house decorator, and a piece or so of black heel-ball from the shoemaker, are all the absolute essentials; while a few lead weights or wafers greatly assist in steadying the paper, which is simply placed over the brass. Then the outline is indicated by rubbing the fingers or heel-ball round, and the enclosed space entirely gone over with the heel-ball, thus producing a kind of negative. If the brass is very much dented and scratched, a perfect rubbing can often be obtained by just working until the various details are seen plainly, and then going over the black spaces with a rather pointed piece of heel-ball when the rubbing is spread out on a smooth table. Collectors usually cut out the rubbings and carefully mount them, arranging them just as they were on the church floor.

Sometimes it is desirable to sketch a whole or part of a brass or rubbing. If this is done systematically, splendid practice may be obtained in reducing to scale. The brass of Sir Robert Septvans (seven fans), 1306 A.D., in Chartham Church, Kent (Fig. 5), was studied in this way. A measuring rod was placed beside it, and a two-foot rule across. This last being moved down a foot at a time enabled the dimensioned sketch to be made rapidly and approximately correctly, in a short time, by dividing the paper into inch squares, and drawing each part within its proper square. Only those who have tried to draw from objects flat upon the floor will appreciate the great help that this method affords. Then, of course, nothing but drawing each separate feature in this way can impress them thoroughly upon the memory. No rubbing, however perfectly taken, does the pupil the good that a little drawing of this character does. Both things should be done, however. This brass represents Sir Robert clad in complete mail, his knees protected by ornamented plates (Fig. 11), legs crossed; his mittens hanging below his clasped hands (Fig. 10); ailettes, each charged with a winnowing fan, above his shoulders; sword and belt,



both highly ornamented (Figs. 6, 7, 8, and 9); mantle beautifully arranged and charged with fans; and his short shield upon his left arm. Many other points might be noticed, but the reader's attention is drawn to the enlarged sketches of parts, which are practically arranged just as they were taken from the brass. It is interesting to note how the brass engravers represented mail; generally it was managed by series of semicircles arranged in different ways. Two common ways are given in Figs. 3 and 4. These marks are by no means of the same size or curvature, so could not have been made with a tool, and in some places are packed closely, perhaps to show reinforcement.

It will probably be convenient to notice the names of the principal pieces of plate armour. Fig. 19 is a rough sketch of a late Gothic suit just previous to the



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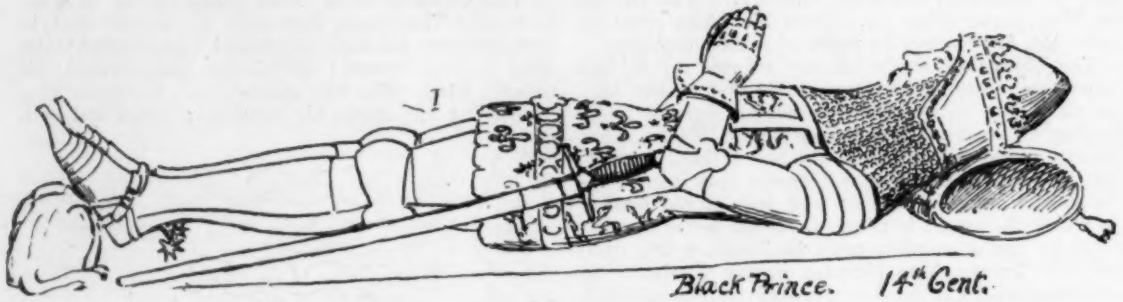
greatest perfection of complete armour. The lettering of the parts is as follows:—A, the *helmet;* A^1, the *visor* or face cover; B, the *cuirass* (breastplate and backplate); C, *braconnière* or skirt of plates (*taces*); E, *pauldrons* (that to the left is much larger than the right for additional protection); F, *rere-braces* (upper parts of arm covers, *brassarts*); G, *cubitière;* H, *vambrace* (lower part of arm covers); I, *gauntlets;* K, *cuishes;* L, *genouillères;* M, *jambs;* N, *sollerets;* D, *chain-mail.*



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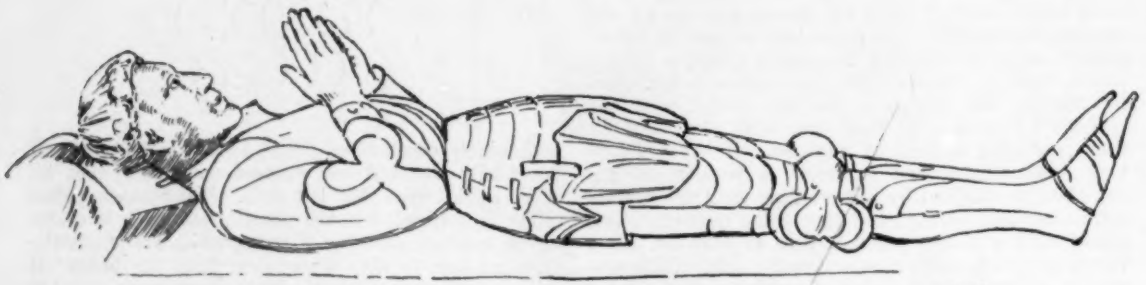

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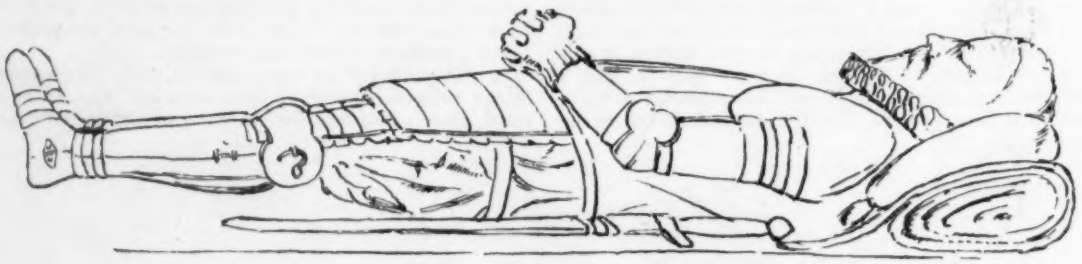

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Sketches of three effigies typical and respectively of the fourteenth, fifteenth, and sixteenth centuries will serve to give general ideas of the armour of those times. That of the Black Prince, Canterbury (Fig. 16), shows the head protected by the bassinet, to which is attached by a kind of lacing the large mail collar, *camail*, resting on the great helm; the feet encased in the pointed *sollerets*, which reached to about the triple spur straps, resting on the back of the usual dog, perhaps introduced to permit the spurs to be shown; the jambs, which also covered the heels; the *jupon*, a surcoat emblazoned with the *fleur-de-lis* and lions, and having on the breast the three-pointed label, the mark distinguishing the eldest son of an English king; and the gauntlets, with the projecting knobs on the knuckles.

Beauchamp's effigy at St. Mary's, Warwick (Fig. 17), differs considerably, greater freedom being secured by increasing the number of parts, especially in the regions of the waist and knees. A series of overlapping plates (*taces*) surround the waist, and additional protection is afforded by attaching long plates, known as *tassets*, to this girdle. Referring to Fig. 18, it will be seen that this tasset became a very important feature in the next century, and later the whole protection for the front of the thigh was a series of scale-like plates, often termed *lobster tails*. The immense size of the *cubitière* and *genouillères* is characteristic of the times, and was occasioned by the parts in their vicinity being

cut away to allow of free movement. Just below the chin is seen the ridge of the *grande-garde*, giving additional protection to the left shoulder.

The Smythe effigy marks a stage in the gradual rejection of plate armour, the full breeches being plainly seen crossed by the strap which holds the thigh armour. Here the *sollerets* completely cover the feet, being hinged on the outside, and the *genouillères* are secured by prominent hooks and eyes. The new position of the hands, protected by ribbed gauntlets; the ruff; the sword lying by the side, now entirely free from the body; and the pillow for the head instead of the helm, all point to a breaking away from traditional arrangements, effigies soon being made reclining, kneeling, and at last standing upright. This gradual assumption of life is most interesting to trace.

CARDBOARD MODELLING.

BY FELIX T. KINGSTON, BARRY.

Model No. 9.—A Tray.

TO be bound and covered. Curves are here introduced for the first time (Fig. 9*a*).

Having cut out and fixed the model, proceed to bind the top edges. In order to make the binding-cloth adapt itself evenly to a curved edge it must be stretched. It is a well-known fact that cloth will not stretch in the direction either of the warp or the woof, but only diagonally. The ordinary binding-strips will therefore

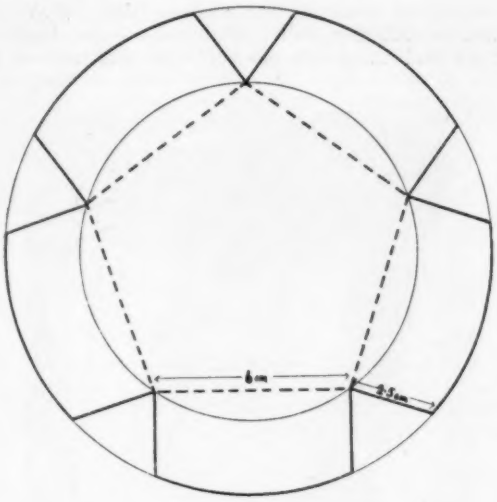


Fig. 9*a*.

be of no use, and strips must be cut for this purpose diagonally (or "on the cross," in the popular phrase) from a piece of *ungummed* cloth.

Fold these strips exactly along their length (Fig. 9*b*), and then stretch them along the folded edge, when they will appear as in Fig. 9*c*. Apply seccotine to the

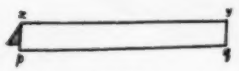


Fig. 9*b*.

Fig. 9*c*.

card (not to the cloth); and having cut off a piece of binding of the required length, fix it to the gummed card. A little vigorous rubbing and pressing with, say, the handle of the knife will remove the puckering of the edge *p q* (Fig. 9*c*). Stretch the cloth as much as possible when affixing it to the card.

Next, bind the vertical and bottom edges, exterior. Use ordinary gummed strips for this.

Cover the interior, the base first, allowing a margin of binding-cloth to show along the top. (See Fig. 9*d*.) Cover the exterior with a paper of different design.

Fig. 9*d*.

The pentagon should be constructed by the pupils according to any method by which they have been taught—that is, given either one side (as in Fig. 9*a*), or the radius of the circumscribing circle. If the

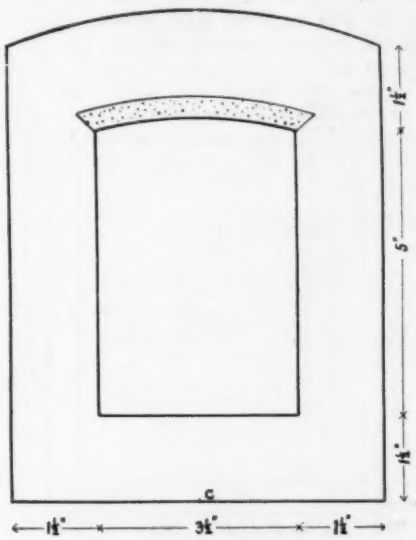


Fig. 10*a*.

geometrical work of the class has not yet included the regular pentagon, make the tray square or hexagonal, the essential point being the inclusion of curved edges: The tray will certainly look better if its sides are made sloping, though in this case the time required to complete it will perhaps be unduly lengthened.

Model No. 10.—A Photo Frame.

The frame has been simplified in construction as far as possible, because of the necessity of avoiding elaborate

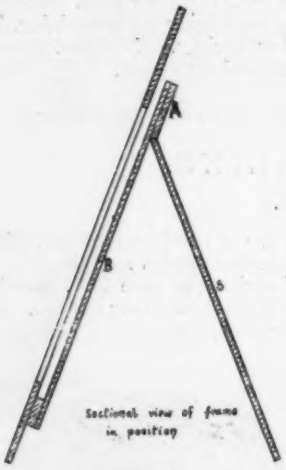


Fig. 10*b*.

detail. The model should be made to fit a particular photograph; dimensions given in Fig. 10*a* will fit cabinet size. Centre of arcs is at *c*.

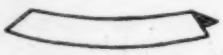


Fig. 10*c*.

Cardboard of a thicker kind than that used up to the present will be most serviceable; thin card will not give the requisite amount of rigidity. The curves

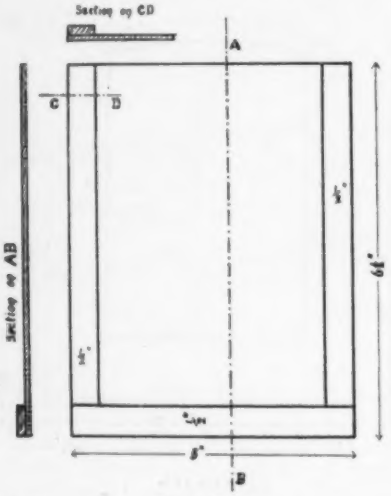


Fig. 10*d*.

at the top may be cut freehand with the knife; do not try to sever the card at one stroke.

Bind the curved edges before the straight ones. As before, cut the strips for these edges (and for these only) diagonally from ungummed cloth. The convex (outer) curve is a repetition of last model. For the concave (inner) curve the strip of binding-cloth will

Fig. 10*e*.

be stretched along its outer edges (Fig. 10*c*). Considerable difficulty will probably be experienced in cutting and fixing this piece, for its ends have to be

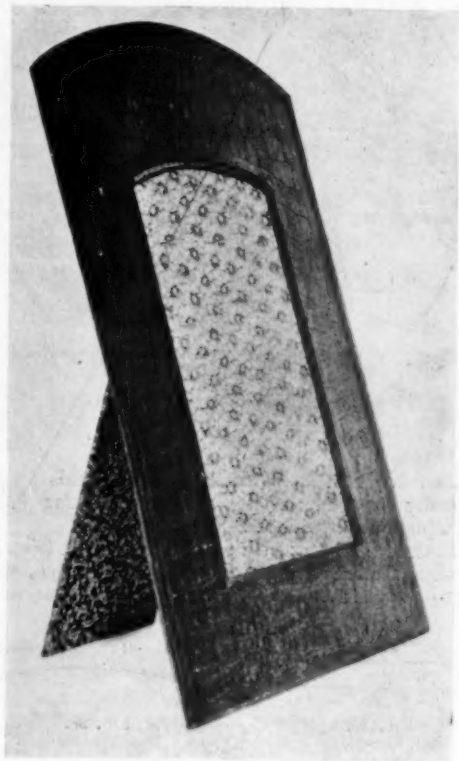
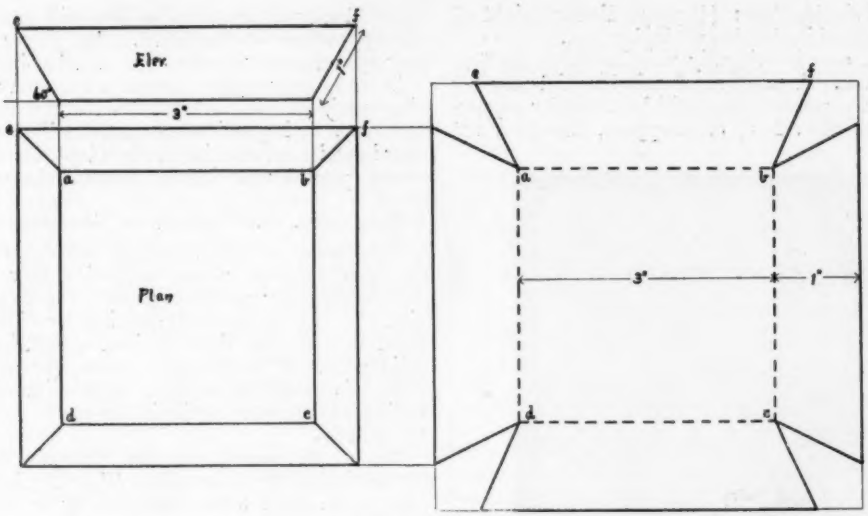


Fig. 10*f*.

mitred to ensure its covering the dotted space in Fig. 10*a*. For method of binding the remaining inner edges, see Model No. 5 of previous stage (*Practical Teacher* for June 1909).



FIGS. 11*a* and 11*b*.

Cover the front and the back, each with *one* piece of paper. This is the most difficult exercise the pupil has had to perform up to the present. An exact fit is not possible unless previous cutting and binding have

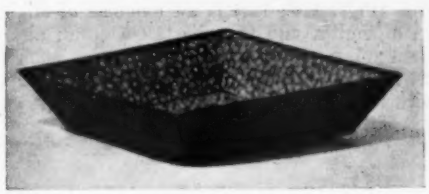


FIG. 11*c*.

been done accurately. An embossed paper should be chosen for the front side.

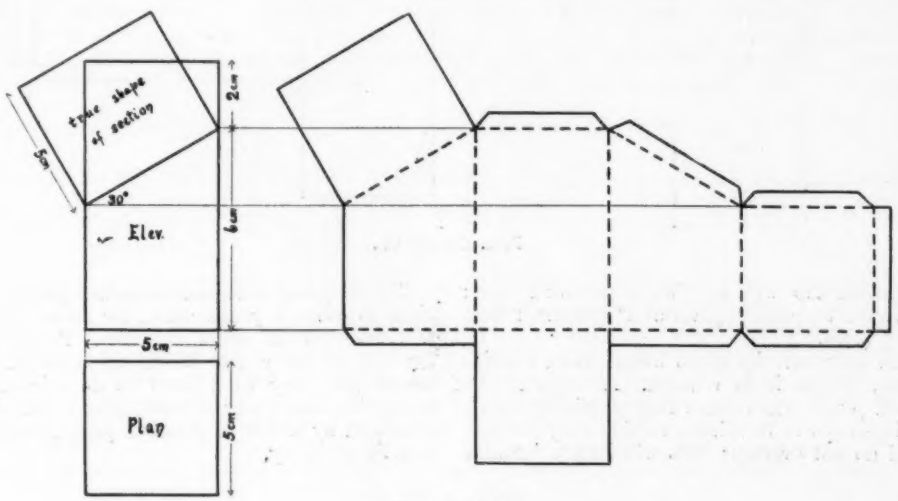
For the back of the frame take a piece of card $6\frac{1}{2}'' \times 5''$ (Fig. 10*d*, same as marked B, Fig. 10*b*), and glue round three edges thick strips of card $\frac{1}{4}''$ wide. Cover this, and glue to back of frame to form a slot in which to slip the photograph.

A support for the frame will next be made. Take a piece of card $7\frac{1}{4}'' \times 2\frac{1}{2}''$ (Fig. 10*e*, same as marked S, Fig. 10*b*); cut off 1" from one end, and hinge it back in the position from which it has just been severed. For construction of hinge, see Model No. 8.

Glue the part A (Fig. 10*e*, or 10*b*) to the back of the frame.

MODEL NO. 11.—A SLOPING TRAY.

The difficulty of working an exercise such as this depends on the data which are given. In previous cases where a model similar to this has been given the requirements have been simple and easy to fulfil. To construct a sloping tray it is necessary to know three of the following:—(1) Length of base (or bottom diameter); (2) length of top edge (or top diameter);



FIGS. 12*a* and 12*b*.

(3) length of sloping face; (4) perpendicular height of tray; (5) angle of inclination of sloping face.

The easiest case is evidently that in which the first three are given. A problem of suitable difficulty for the pupil at the present stage will be found by supplying him with Nos. 1, 3, 5. Suppose, therefore, the

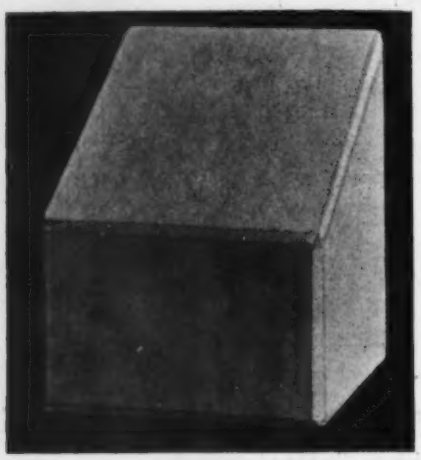


Fig. 12c.

base of the tray is to be 3″, the length of sloping face 1″, and the angle of inclination of sides 60°. The exercise now involves a knowledge of solid geometry. Fig. 11*a* supplies all necessary particulars.

Draw elevation first, then plan, the aim being to get first the length of top edge *ef*. From Fig. 11*a* the development 11*b* will best be constructed thus: Draw *abcd*, then the outer square at 1″ distance; next make $ef = ef$ (11*a*).

The model may have its edges bound, both interior and exterior, before it is covered. As regards the most forward pupils, the teacher may require the ends of *all* binding-strips to be mitred, so that they lie edge to edge and do not overlap; this will largely increase the difficulty of the exercise, but will greatly enhance the appearance of the model. The slower pupils may be required simply to cover the model as in Fig. 11*c*.

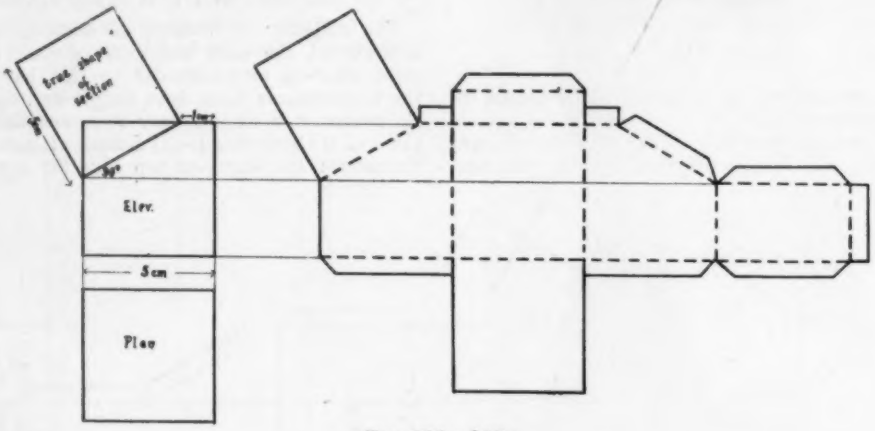
It will amply repay to make a full study of the possible variations in construction and ornamentation of this tray, for it provides an excellent illustration of the way in which an exercise can be adapted to the capacity of each pupil by varying the data and the requirements.

Model No. 12.—Section of Geometrical Solid.

Care must be taken here to select an exercise of the very simplest character, seeing how elusive the most elementary problems prove to be in actual practice. If the scheme of drawing provides that the child has by this time received a sufficient grasp of solid geometry to warrant a more advanced exercise, both this model as set, and the one immediately preceding, should come earlier in the course—say, at about the middle.

One of the easiest exercises that can be chosen is the section of the square prism (Fig. 12*c*), in the present case 8 cm. high, 5 cm. base, cut by an oblique plane (at 30° to ground) perpendicular to two faces, and meeting the other two 2 cm. from the top. The plan and elevation, with true shape of section (12*a*), give all that is necessary for drawing the development (12*b*). Only one part of the prism is shown in photo (12*c*), but both parts should be made up.

Choose a plain paper for covering. The section of the cube (Figs. 12*d*, 12*e*) is an exercise of slightly increased difficulty, and may be taken as an alternative if desired; but as there is at this point such an extensive field to choose from, little difficulty will be met with in finding something adapted to the capacity of the pupil.



Figs. 12*d* and 12*e*.

The foregoing dozen exercises will probably be sufficient to cover a year's work, for some of the models will take several hours to make. Pupils who reach the end of the course before the termination of the school year may be allowed to do original work, or to continue the study of sections of geometrical solids, a method by which they will acquire a thorough grasp of solid geometry.

SCHOOLS AND MANUAL WORK.

The Problem of Pauperism.

THE concluding session of the third annual conference of the British Constitution Association was held on Saturday in Cambridge, when a discussion took place on a paper read by Lady Darwin on "Education and Pauperism." Mr. S. H. Butcher, M.P. for Cambridge University, presided. There was, he said, a most pathetic irony about the thought that only some 40,000 out of 180,000 children leaving elementary schools every year unskilled and untrained thereafter attended continuation or technical schools. The others were set adrift at a moment when they ought to begin learning to be useful. One result must be eventual unemployment for a large proportion and a gradual drifting to the down grade. He suggested the raising of the school age and compulsory attendance at continuation and technical classes as two remedies which might to some extent meet the case, as also a utilisation of voluntary effort in conjunction with State action.

Antidote to Pauperism.

Lady Darwin said it was clear that improvements in our educational system which would tend to place young men in a position to earn a livelihood must furnish the most efficient antidote to pauperism. Accordingly it was such improvements she proposed to consider. Proper value could only be obtained from continuation schools by the introduction into the elementary schools of manual work of a great variety for all pupils. Without such manual work in the early stages the instruction in the technical schools was largely wasted, not only on account of the lack of preparation, but also because three or four years had been lost since the pupils left the elementary school. The history of education in England showed how the old trade or practical schools had been almost exterminated, and manual work had to a great extent been relegated to penal schools. Accordingly, since 1861, education had been almost entirely literary. This unfortunate process was now being gradually reversed, but not nearly enough had been done as yet in that direction. Much of the boy labour was demoralising and taught nothing. The return to regular skilled employments after a period of some years during which the boy had had no opportunity of learning a trade was often nearly impossible. A large proportion of young criminals were found to have been errand boys or street traders. The Borstal prison system had been very successful in giving young criminals a start in life, although they had had no previous training in handicrafts. It was remarked that young English emigrants were helpless in practical work, and this afforded evidence of the bad effects of the lack of manual training in our school system. Even the educational effect of athletic games was being lost, for only a few young men played football and still fewer cricket, while the majority were content with watching others playing and speculating on the results. A great proportion of the huge crowds at League football matches consisted of mere lads, many of whom sacrificed a meal to save the coppers for the gate money, or begged it from others. Practical work at schools, which was already begun at the kindergarten stage, should be continued later and gradually increased in difficulty, thus laying the foundation for the future career of the pupil. Manual work should have an importance equal to that of the rest of the school work. Its diversity would enable a boy to choose his trade with intelligence, and would prevent him from being helpless when industrial conditions changed. Practical work would lead to the love of handicraft. It would not imply the learning of a trade, but would lay the foundation of many trades.

Industries for Boys.

Lady Darwin referred to the prejudices of English boys against doing what was regarded by them as women's work. Thus cooking was an almost undeveloped industry for boys, except perhaps in seaports, but an evening class had now been started in Cambridge. Again, tailor's work, in London at least, was said to be largely in the hands of foreigners. The later technical education of girls would necessarily be somewhat different from that of boys, but it needed special consideration. Lady Darwin recommended as remedies for those defects in our educational system which led to pauperism the large introduction from the earliest age of diverse kinds of manual training, the prolongation of attendance at school, and the formation of trade and continuation schools, with arrangements whereby boys who are already at work should be given time for attendance at these schools.

DRAWING IN PUBLIC ELEMENTARY SCHOOLS, DENVER, COLORADO.

BY CHARLES M. CARTER, DIRECTOR.

Sixth Year.

DRAWING from life, or "pose drawing," as it is sometimes called, has been practised more or less in every year. The results vary largely in proportion to the knowledge of the teacher. Examples are shown by Figs. 1, 2, and 3, Plate I., also by Plate IV. In the lower grades "skeleton lines" are used at first.

In light and shade work it is supposed that each drawing gives a complete representation of everything seen through a "finder," including background and ground. Indications of outlines are made so delicately that they disappear in the shading. Oftentimes we place in one corner of the drawing, in a definite space, a miniature outline sketch of the subject. This is filled with numbers representing the average value of each principal part: 0 is to represent absence of shade; 1, the lightest value; 2, the next darker; 3, still darker; and so on, until the value of each space has been determined.

Ordinarily five or six numbers are sufficient. Sometimes, after this analysis, a miniature sketch of the shading is made on a piece of paper about 2 by 3 inches

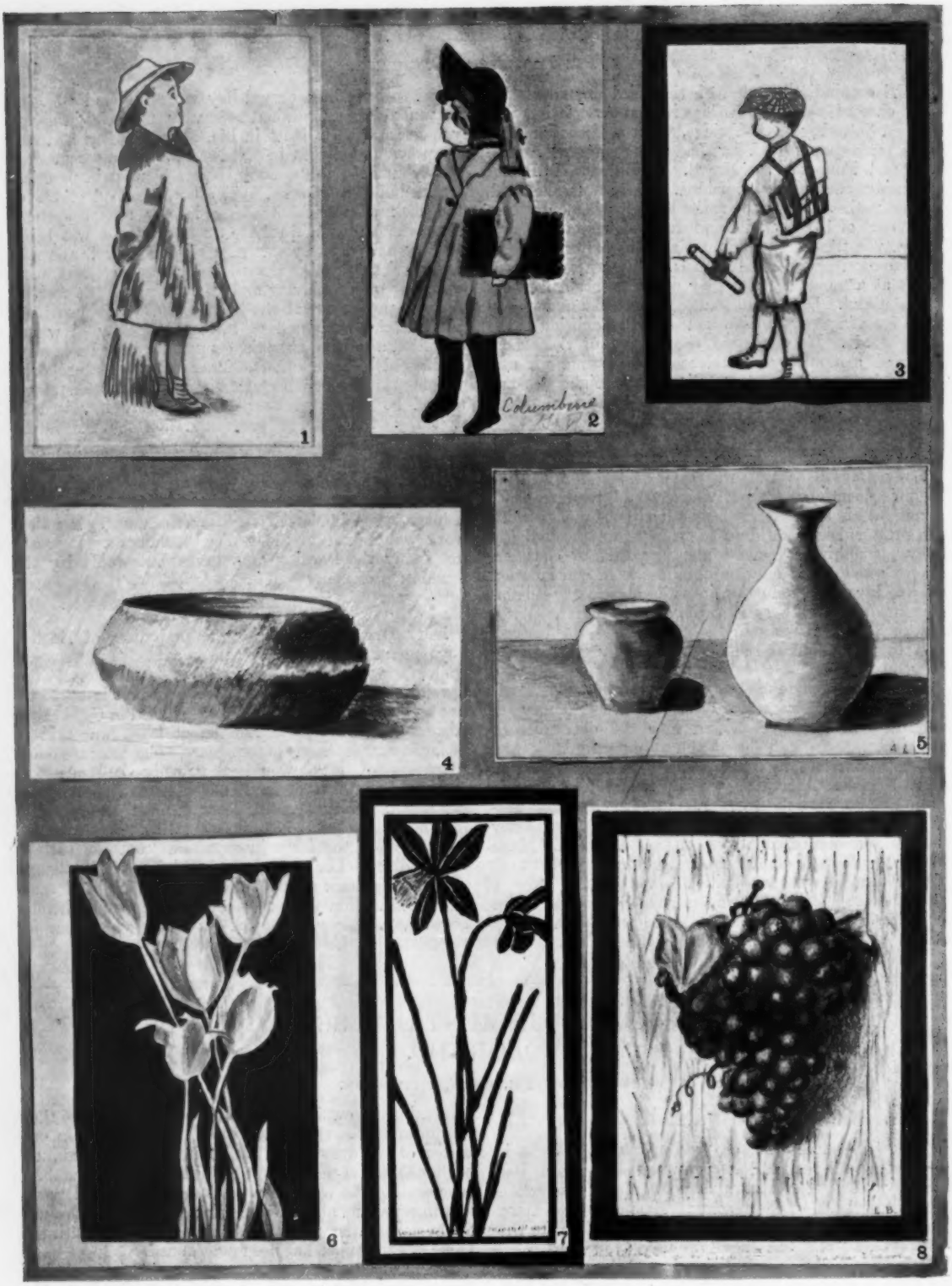


PLATE I.

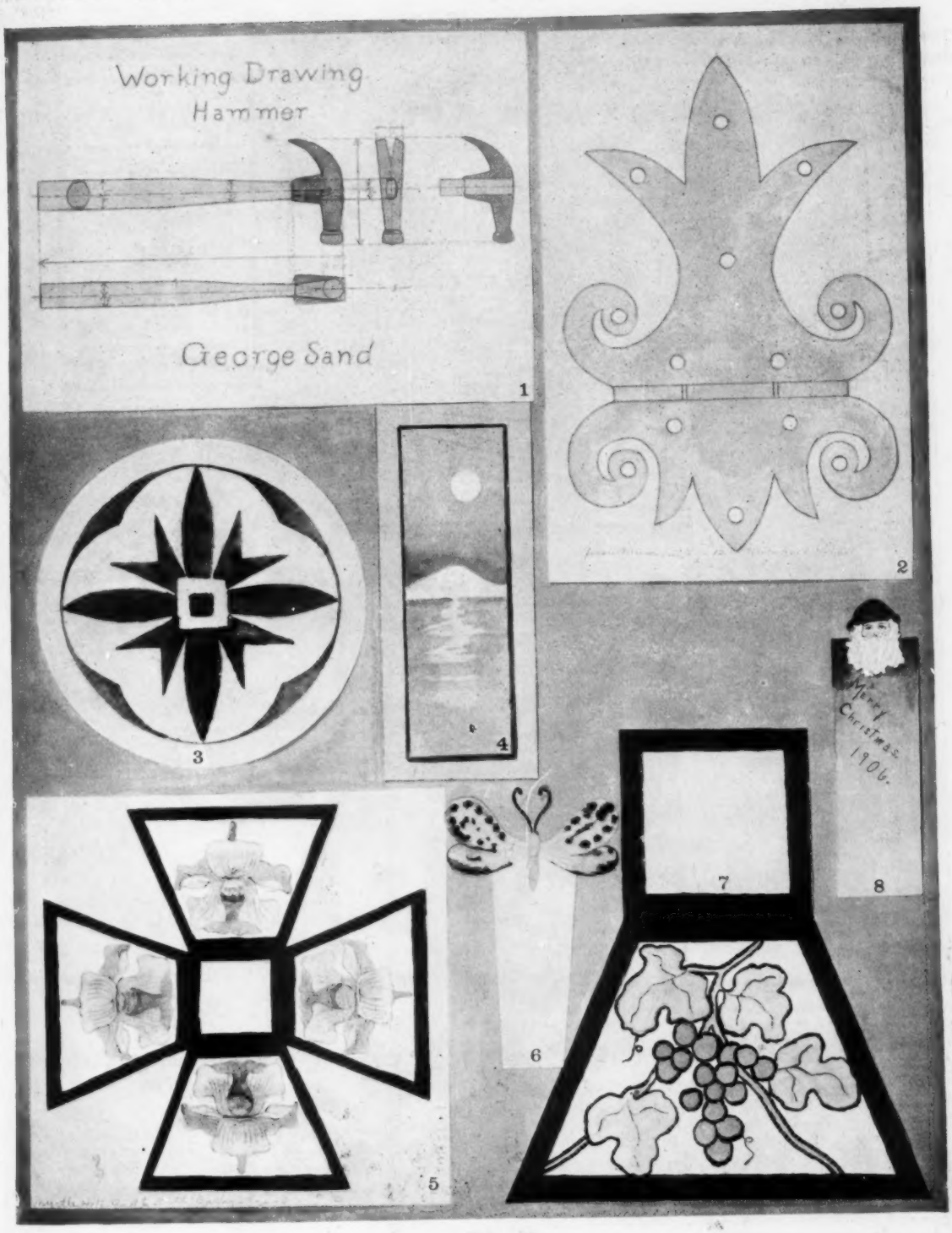

Working Drawing
Hammer
George Sand
1
2
3
4
Merry Christmas
1906.
5
6
7
8

PLATE II.

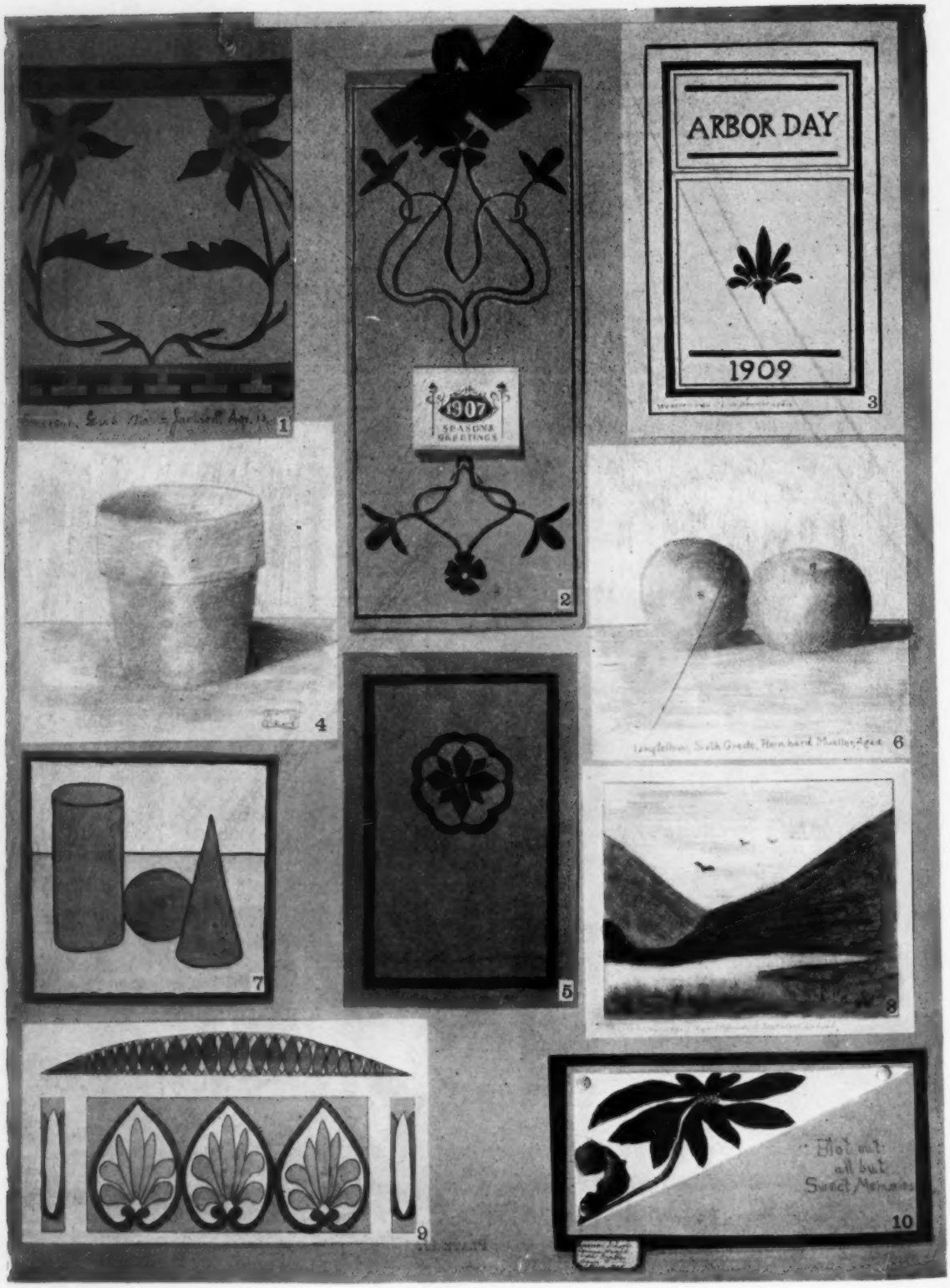


PLATE III.

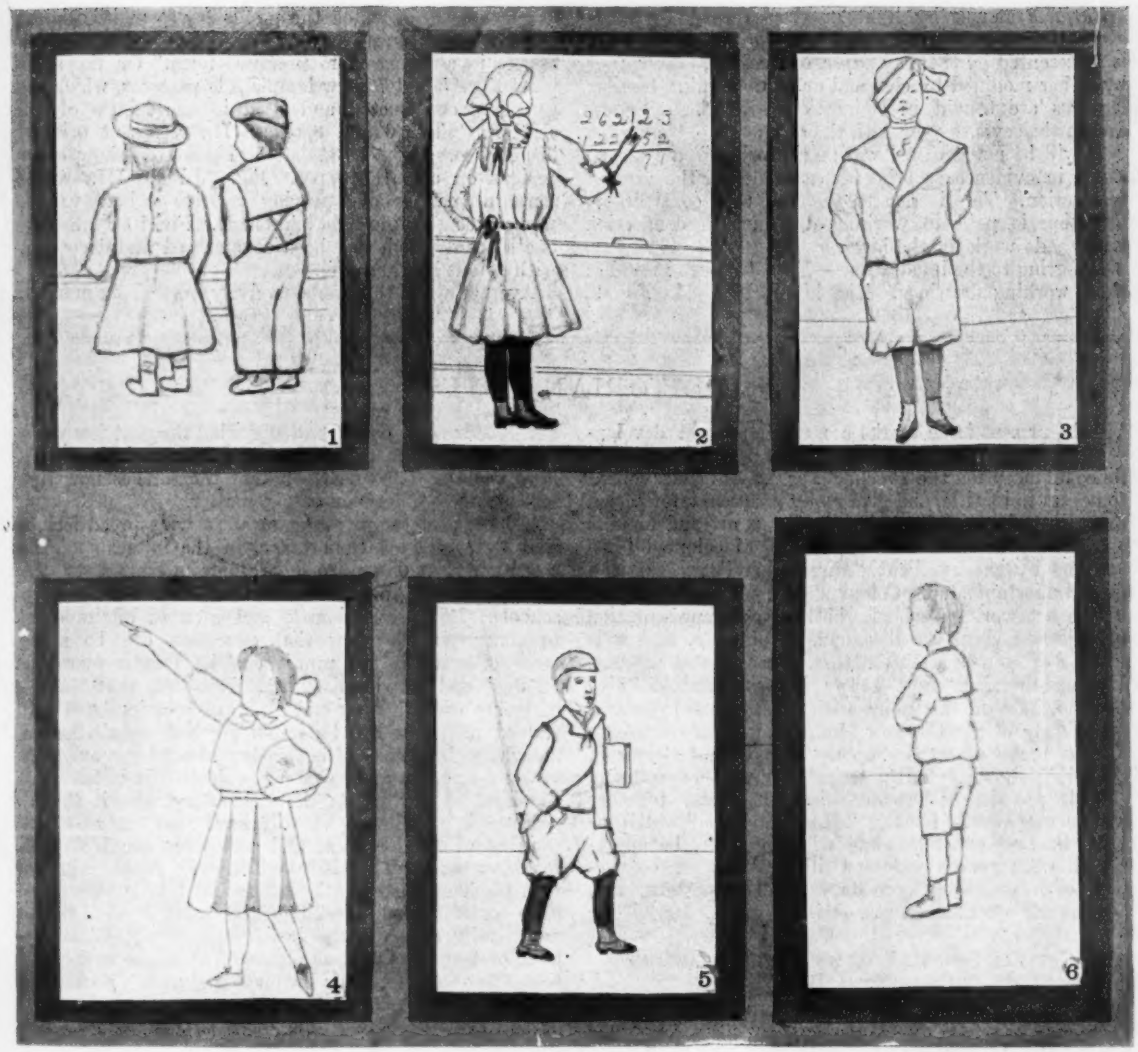


PLATE IV.

in five or six minutes, the object being to compel the pupil to fix his attention on the principal features of the subject. The large drawing is carefully made afterwards. Pupils are encouraged to make "booklets" of clippings from magazines, illustrating different ways of using lines in shading. Examples of regular work of this year are shown by Figs. 4 and 5, Plate I., and Figs. 4 and 6, Plate III.

In connection with the first study of light and shade, we have found it very profitable to give exercises in making, what we term for convenience, the "ideal" sphere, cylinder, and cube. The two first are given in the sixth year. The idea is to tabulate what we ordinarily expect to find in the light and shade representation of these fundamental forms—ideas which may be applied to many other subjects based on these forms. The drawings are generally made on gray paper, or on a large scale on the blackboard. Following are the points we teach pupils to consider in drawing the "ideal sphere," or similar forms.

The outline should show—A, Boundary of the sphere. *B*, Position of the imaginary ellipse dividing the light from the shadow side. *C*, Elliptical form of the cast shadow.

The shading should show—D, The high light. *E*, The shadow. *F*, The cast shadow. *G*, The half light. *H*, The reflected light. The light is separated from the shadow side by a circle. This dividing line generally appears as an ellipse. Actually it is not a definite line, but the position of the part of the surface marking the merging of light into shadow.

The drawing should show—I, A perfect gradation of light and shade on any imaginary straight line radiating from the high light. *J*, The boundary of the sphere blurred and indefinite. *K*, The cast shadow generally darker than the shadow. *L*, The cast shadow sharpest and darkest near the object making it. *M*, All details in the light, shadow, or cast shadow, subordinated to the general appearance of the light, shadow, or cast shadow.

Surfaces struck by light are represented by *white chalk*, those not struck by light by *charcoal*. Half light is represented by the *gray paper*, or *blackboard* alone; or by either modified by charcoal or white chalk. Similar features are taught in connection with the cylinder, and in the seventh year with the cube.

It will be noted that "working drawings" are not so much in evidence as other departments of the general instruction. This is due to the fact that considerable attention is paid to working drawings in connection with shade work for the boys.

Referring to the illustrations—Figs. 1 and 2, Plate II., show working drawings. The hinge, Plate II., Fig. 2, is an exercise in which the pupils try to make original shapes. Sometimes they are cut from paper, which assists in securing more practical form. On the same plate Figs. 5 and 7 show lamp-shade patterns, which are generally constructed and used in the homes of the children. Figs. 6 and 8, Plate II., represent original bookmarks. Figs. 1, 3, and 5, Plate III., show cover designs on coloured paper. Fig. 7, Plate III., represents a manner of studying relative colour values, without considering light and shade. Fig. 10, Plate III., is a blotter, which has been constructed and decorated with colour by the pupil.

Average age of this grade, twelve years and six months.

EDITORIAL NOTES.

THE present issue marks a most important development in the progress of this school magazine. Since its inception the *Practical Teacher* has endeavoured to act up to its title, and give really practical information regarding educational work. As far as art and manual work are concerned, the introduction of coloured illustrations by the excellent "three-colour" process is a most important step. Colour should play a great part in the art work of schools, both in the representation of objects and in the development of taste, and it is worthy of greater attention than it receives at present. We are therefore most happy in being able to give teachers help on this point with illustrations in colour. Mr. Young of the Glasgow High School will contribute a short series of articles upon "The Use of Colour in Schools," showing the practical methods of utilising chalks, pencils, and water-colours. These, together with some awards for the "Honours Page," will provide the first examples, and will, we hope, be appreciated. Afterwards coloured illustrations in connection with crafts in secondary schools—pottery, art, needlework, enamelling, etc.—will be given.

"Central Schools" of an "Industrial and Commercial Bias."

In a recent number we wrote that "psychologists, physiologists, and practical teachers are now unanimous in acknowledging that handwork is also brain work." A complete vindication of this statement is given by the decision of the London County Council to establish "practical" schools. The report presented to the Council by Mr. Ernest Gray, and his speech on introducing it, will be read with more than pleasure by all those who have laboured and fought for the cause of manual work during the past twenty years. Space forbids us giving them in full, but the following excerpts will serve to show how completely the educational value of handwork is now recognised by the largest educational authority in the world. The report states:—

The Present Position.

"The higher elementary and higher-grade schools have therefore, since the appointed day, been left in a somewhat anomalous position. It has been impossible for them to retain their former place in the educational system, and no definite new place has yet been found for them. The question of the organisation and curriculum which should be given to these schools has, indeed, been one of extreme difficulty, and much thought and labour have been devoted during the past few years to the endeavour to find a satisfactory solution. We have come to the conclusion that the time is now ripe for coming to a decision on the matter.

"There is at the present moment a widespread feeling that it is of great importance, in the interests of the community at large, to give more attention to the development of 'practical' education in the elementary schools. Both educationists and men of affairs seem to concur in the view that education can be made more effective if the pupils can be taught more by 'doing' and less by listening. It is felt that the intelligence of both boys and girls can be stimulated and trained not only by the imparting and acquisition of knowledge by means of books, but also by the exercises of hand and eye upon concrete objects. It is felt that the kind of boy whom the elementary schools should produce is the boy who will have had an all-round training of his faculties, and will have acquired that readiness and adaptability which will enable him to turn his hand to the task that awaits him in the workshop or factory. Working-class parents are themselves fully alive to the importance of obtaining this kind of training for their children, as is shown by the recent formation of the National Industrial Education League, which has for its object the promotion of a system of education for boys in the elementary schools which will enable them to hold their own in the industrial world. The formation of the various Trade Consultative Committees, which are now assisting the Council in its work of Technical Education, also shows the importance which the workers in the various trades attach to education. Another sign of the present trend of thought is given by the deputation from the Metropolitan Borough Councils which recently waited upon the General Purposes Sub-Committee and called attention to the importance of making education in elementary schools more practical.

"We are of opinion that this movement of public opinion gives an indication of the method which the Council should adopt in the organisation of the proposed central schools. They should, in our opinion, be schools which will give their pupils a definite bias towards some kind of industrial or commercial work, while ensuring that their intelligence should be fully developed. They should occupy a distinct position from the secondary school, though that position will not be in any sense inferior. They should avowedly frame their curricula with a view to the pupils leaving at an age between fifteen and sixteen. Their courses should be so framed

as to provide for the pupils the best possible equipment for entering upon the industrial or commercial world as soon as they leave school, while at the same time qualifying them to enter upon a special course of training for some particular industry at a polytechnic or similar institution if they desire to continue their education further. We feel convinced that there are many boys and girls for whom this type of school will be better suited than a secondary school. There seems reason to believe that some of the pupils who during the past few years have entered secondary schools with the aid of junior scholarships have gained little from these schools, and at the conclusion of the course have found themselves unsuited for any of the openings which are usually sought by secondary school pupils. Such scholars would have done better in a school where the course would have been more closely related to the requirements of their future occupations. There is no doubt that at the present time the attraction of the scholarship serves in some cases to outweigh other considerations which should have weight with parents.

Proposals.

"After careful consideration we have decided to recommend the establishment, as part of the elementary school system of London, of a series of higher schools to be termed 'Central Schools.' We propose that these schools should take the place of the existing higher elementary and higher-grade schools, and that they should be fed by contributions from the surrounding schools, as most of the higher-grade schools are at present. They should be carried on under the ordinary regulations of the Board of Education, and thus be free from the restrictions imposed by the higher elementary school regulations. The curriculum should provide in all classes for manual and practical work, and in the case of girls, for instruction in domestic subjects. We do not, however, propose that a uniform time-table should be drawn up for the various schools. The curriculum of each school should be specially considered, and should be determined, with a view to meeting the needs of the district. We propose that the pupils should be selected at the same age as those who are selected by the junior county scholarship scheme to attend secondary schools—namely, between eleven and twelve, and we are of opinion that the parents of those who gain scholarships should be given the opportunity of choosing either the secondary school or the central school. The schools should be organised on a four years' course, and provisions should be made for bursaries to be held by pupils on their attaining the age of fourteen, under the clause in the Education (Administrative Provisions) Act, 1907, which allows scholarships to be held in public elementary schools. These bursaries should not exceed five hundred in number; they should consist of maintenance grants from the age of fourteen at the rate of £10 a year. The average length of tenure may be estimated at one and a half years, so that the total annual cost will be about £7,500. There will probably be many children who now win scholarships who will be found to be better suited for the education we propose to give in the central schools. If a large number give up their scholarships, there may be sufficient money set free for the purposes of the bursaries without any alteration in the percentage of marks which have been held to qualify for the scholarship; but if this forecast is not realised, we may have to raise slightly the standard of the scholarship examination.

"Each of these schools should have a commercial or an industrial bias, or both; and in order that the parents of candidates for admission may be given an opportunity of realising the advantages afforded by the schools, we propose that they should be furnished with a short descriptive pamphlet, and that they should attend for personal interview before the managers and the head teachers. In order to emphasise the special character of these schools, we propose that they should be under the direction of specially constituted bodies of managers, being treated as non-local schools under the provisions of the Act of 1902."

In presenting the report, Mr. Gray said he wanted to dispose of two popular fallacies which had got about since the report was published. It was sometimes alleged, quite wrongly in his judgment, that manual dexterity required less mental efficiency than did intellectual occupations. But all children, he thought, could be brought to the same mental level through different methods. Children varied in capacity, and this could be developed on particular lines. The scheme before the committee recognised this, and the desire was to train the children who differed from those adapted for the ordinary secondary schools. The scheme was not to train for a trade, but to attempt to develop "gumption." He used the word, for the want of a better one, to express aptitude, adaptability, and capacity. They wanted to utilise trade processes in the training, but not to apprentice any child to a particular trade. It was to be used for the general development of intelligence—the securing of accuracy of hand and eye and carefulness of habit. And they had in co-operation with them employer and workman, manufacturer and trade unionist, as an advisory committee. The training would be for trade generally, and not for any particular trade. They had also the support of the municipal authorities of London. They proposed extending their higher elementary and higher-grade schools with some others to be formed, and to reorganise these schools with an "industrial or commercial bias"—a bias of education of an industrial or commercial character. They would not be secondary schools, but they would not be inferior, and might ultimately be put under the regulations for technical schools. But they would be kept on the elementary side of their educational work in order to reserve their liberty of action in carrying out the scheme. The selection of the children would be upon the records of their school life and apart from paper examination results. The head teacher would consult the parent in recommending a child to go forward. They recognised that some children who had won scholarships to ordinary secondary schools would have done better in another type of school. They were aware that some of the girls would come out of the secondary schools unable to earn their livelihood. They would have done better in a school of the type contemplated. And poverty was to be no bar in their scheme. For the first time in the history of London's education there would be a certain number of scholarships or bursaries, awarded to children in these central schools, which would be equal to secondary schools, although differing from them. For a beginning £500 would be awarded for these bursaries, and a fresh avenue would be provided for the bright child who desired to progress from the elementary school to some higher education, and could

do so on the manual rather than on the literary side in the older-fashioned type of school. Industrial, commercial, artistic, and scientific education could all find a place in this type of school, and it would, he believed, meet a national want.

Alderman Shepheard congratulated Mr. Gray upon the report and his speech. But he congratulated him more on the nature of the scheme he had brought before them. It was not his (Mr. Shepheard's) scheme, but ever since he was in America he had the idea of what were called "motor methods" warmly at heart. He had tried to bring them about, but made little progress. None the less, he was thankful that Mr. Gray had been able to do something in the direction. What he liked about the scheme was that there was to be no teaching of trades in the schools, but a teaching by methods of trade. Those brought up on the teaching of what were called the humanities, he knew, looked askance at this. The scheme was more ambitious than his experiment would have been, but he welcomed it, and should give it his heartiest support in the carrying of it out. But difficulties lay right in front of them. It involved a mixed type of education in central schools fed from contributory schools all round. The age of entry was eleven to twelve, with a four years' course, and here it was of a secondary school type, but the teachers' salaries were not to be above the salaries in the elementary schools. He was glad, however, that the attempt was to be made, for he believed in the suggestion that they should teach in this way.

Mr. Graham Wallas said that for the last twenty years the tendency had been in this direction. The drawing, drill, manual training, etc., had been taken from the time for book-learning. Before that time the education was almost entirely bookish. But this raised a great and serious question of principle. There was little time for English, for reading out language as expressed by the great authors; little time for history or geography; and this proposal would lessen the small time given to those subjects. There was in it all a strong prejudice against the education of the working-classes.

Mr. Gray: I am not aware of it.

Mr. Wallas said he was not accusing Mr. Gray of sharing that prejudice, but there was an idea abroad that the education of the working-classes should be kept "practical." That idea had kept back education in England during the nineteenth century. They had twenty hours of instruction in educational subjects, and the rest of the time was given to Cowper-Temple teaching. "Bible *plus* manual instruction" was the idea of the classes for the education of the masses. In this scheme the echoes of the old controversy were revived.

The Rev. Stewart Headlam congratulated Mr. Gray on the discretion and tact he had used in getting this matter through. He laid stress on the word "bias," and he thoroughly agreed with Mr. Wallas that if they were to make a good industrial or commercial man it could not be done without the aid of a literary training. But the fight was not that day. When they got to the time-table that question would arise. It had been said that England was in danger of a literary proletariat, but he would save the country from a literary proletariat by what had been referred to as "the humanities"—a big word for it. An intelligent teaching of the Bible was one of the best literary subjects in the world. They were getting a kind of secondary school, under the Elementary Education Acts, in connection with their own council schools, and that was what he welcomed.

The following resolutions amongst others were then passed after some discussion of detail—namely,—

"That a system of schools be established giving an educational course not provided in the elementary or secondary schools.

"That the schools referred to in the foregoing resolution do have an industrial or commercial bias, or both.

"That the schools referred to in the foregoing resolution be designated 'central' schools.

"That certain existing higher-grade schools and higher elementary schools be recognised as falling within the type of school referred to in the foregoing resolutions, though the curriculum may not at present have such an industrial or commercial bias as is contemplated in the second resolution, but that such schools be brought into accordance with the general scheme as soon as possible.

"That elementary school pupils who will be less than twelve and not less than eleven years of age on July 31 in the year of admission, and who will be, as a rule, working in the fifth or higher standard at the time of examination, be eligible for admission to the central schools; and that the scholarship examination be retained for all such pupils as at present.

"That admission to the central schools be based on—

"1. A declaration by the parent of the child seeking admission of his intention that the child shall remain in the school long enough to justify the change. In order that the intention of the parent may be ascertained, the head teacher of the contributing school shall arrange an interview with the parent or guardian of each eligible pupil, and at this interview the question of the child's admission to a central school, and the type of central school for which he is suitable, is to be discussed.

"2. A recommendation of the head teacher of the contributing school which shall have regard to the whole school career of the pupil in question.

"3. A consideration by the head teacher of the central school of the papers submitted by the pupils at the junior county scholarship examination, together with such other evidence of the child's career as may be produced, provided that in the case of an industrial school an examination of the pupils in drawing be held at the central school, and the results of this examination be considered together with any other suitable evidence of their manual dexterity.

"That a pamphlet be prepared for submission to the education committee setting out for the information of parents the relative advantages of the central school and the secondary school, so that eligible children may be sent to the type of school for which they are qualified.

"That central schools be organised according to circumstances, either as mixed or with separate boys' and girls' departments.

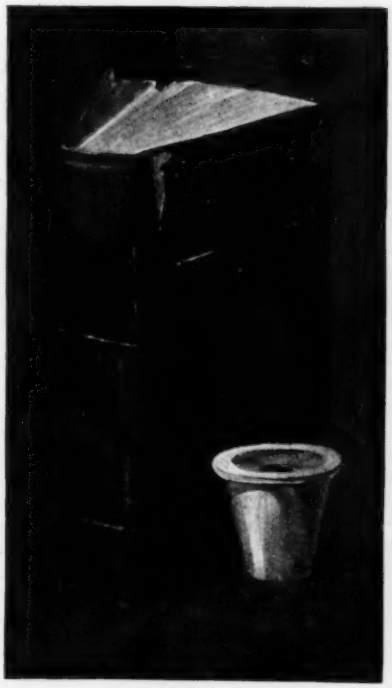
"That the maximum size of a class in a central school be forty pupils.

"That the organisation of central schools do always provide for courses extending over a period of four years.

"That instructors or instructresses of manual training or domestic economy centres on the site of central schools be under the control of the head teacher of the central school.

"That every girl in a central school do go through an approved course of domestic economy instruction.

"That every boy in a central school do go through an approved course of manual instruction."



THE USE OF COLOUR IN SCHOOL.

THE USE OF COLOUR IN SCHOOL.

BY JOHN YOUNG, ART MASTER, GLASGOW HIGH SCHOOL.

THOUGH the love of colour is universal with children, the colour sense of the average Briton is generally conceded to be a thing that we should not boast about overmuch. We are justly proud of our shipbuilding, mechanical appliances, and many of our industrial products, but the particular merit of the work is seldom due to any æsthetic sense of good colour. In most of our activities colour is relegated to a distinctly second place. We congregate in cities that are for the most part dull, drab, and smoke-ridden; and at least one half of the population clothe themselves with garments which are largely a negation of that beauty which Nature uses with so lavish a hand. Just how we have drifted into this state of neglect it would be difficult to say, but certain it is that the everyday existence of most people would be brightened if they were given the capacity and the opportunity to appreciate colour. This question of capacity to appreciate is a very important one for the teacher, a question which is worthy of his best attention. There is abundant evidence that all children have the instinct for colour; but right and full appreciation can only be developed, like any other mental faculty, by careful training. It is the school we look to as the nursing ground for the development of that saving grace which will prize and cherish the finer qualities of human aspiration. If we do not wish our love of colour to lie dormant, it must be trained and fostered during the school period. I hope my readers do not imagine that I am here pleading for the introduction of a new subject into the already crowded time-table; happily, in this instance, there is no need. Ample justice may be done to this one during the ordinary course of the lessons in drawing, nature study, and science.

In connection with the drawing lesson, colour may be introduced in two ways that will lead to a thorough training of the colour sense. It may be the direct imitation of Nature's harmonies, when fruit, flowers, animals, landscapes, or the human figure will be the models, and the method of expression will be through the use of pigment. An equally useful and instructive line of study may be found in using as models the thousand and one common articles in which man's desire for the colour element has asserted itself. Here, again, the exercise may be imitative and pictorial, and the means of expression would again be pigment; but these exercises may be imitative and constructive, in which case there is a large variety of materials available —coloured papers, clay, cardboard, wool, silk, and fabrics for the younger ones; wood, metal, glass, leather, etc., for the older classes. This should lead up to and be enforced by a series of lessons in which the work is not done in imitation of a given model, but from some original preconceived idea. This would bring the pupil in touch with the actual verities of life in a way that no amount of pictorial representation on paper could ever do. It is not enough to be told or to read about constructive processes; one must actually do the thing. Success could only be attained through repeated effort, but the value of such work as mental and manual discipline is very great.

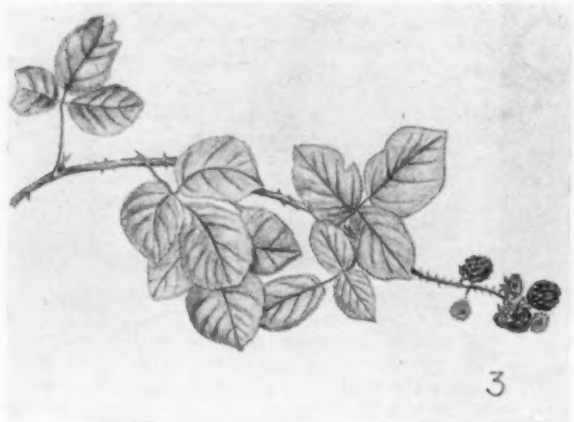
Just how this will be done in each school is a matter for the individual teacher to decide. Indeed, if the teacher is not sufficiently enthusiastic to formulate his own methods and schemes, he will never succeed with a subject which is set about with so many pitfalls for the unwary. The introduction by one or two manufacturing firms of good, cheap, and reliable water-colours, brushes, pastels, and papers has happily removed the worst of these stumbling-blocks. A good outfit for crayon work or water-colour is within the reach of every one.

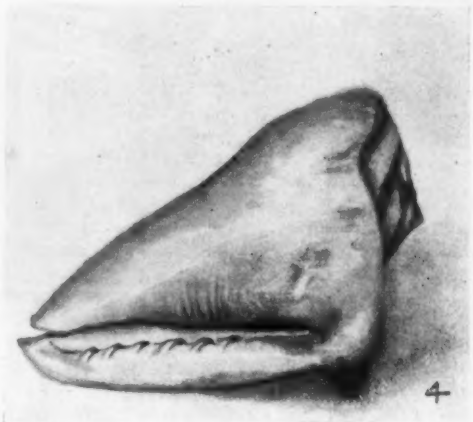
On page 455 are colour reproductions from school exercises done by pupils of the higher classes. They are not ambitious efforts, but the same type of thing can be taken all through the school. The illustrations on the "Honours Page," 458, show also examples of the use of colour in school work. Leaves and flowers without background, graded in difficulty to suit the abilities of the pupils, will make a very good introductory set of lessons if the medium used is water-colour. An apple or other fruit, a book or coloured jar, is more suitable if pastels and coloured papers are to be used. Whatever the model or method chosen, it should be always understood that an artistic rendering of its true form and colour is wanted. There should be no stopping half-way, accepting an approximation or conventional method. The pupil should conscientiously endeavour to put down within his outline drawing as direct as possible the colour which most truly represents the hue and tone of the original. Directness is one of the essential qualities of all colour work, and should be aimed at from the start. In the case of the flower study shown, the student puts down as directly as possible the full strength of red, orange, or green to represent the colour and tone contrast observed between the actual model and the white paper background placed behind it. Of course, this does not mean that there will be no second painting; on the contrary, there is always much of it, but it should be his constant endeavour to reduce it to a minimum. This is the only way to retain that purity of colour which is so important in all colour representation. The washing-up method or repeated smudging with crayons generally leads the pupil into a hopeless mess, which neither he nor the teacher cares to have to put right. All of this will mean a power of analysis which it is impossible to expect from children; hence the necessity for greater experience on the part of the teacher. He must warn the pupils what colours to look for, and how certain harmonies can be produced; and, above all, the work must be suitably graded to suit the various classes. In subsequent papers we propose to describe more fully in detail the colour work of several schools, and to examine and describe some of their methods and results. The illustrations will be for the most part in colour, which is practically equal to placing the actual drawings before the reader.

HONOURS PAGE.

THE "Honours Page" this month is doubly instructive and doubly interesting, because it gives, as nearly as any mechanical reproduction can ever give, the exact look of the original drawings. You have only to imagine the examples on page 458 about twice the size, and you have a perfectly correct idea of what the drawings sent in were like.

We are extremely glad to be able to use a part of this, our first, "colour number" in the service of the "Honours Page." Without a doubt the idea has given a great stimulus to many schools, and has brought forth some really creditable work from pupils of all ages. The letters received from those who have won boxes of colours by their success are always encouraging. Though hundreds of drawings have been sent in, there should, considering the wide area over which this magazine circulates, be many hundreds more. The names of certain schools, to their great credit, occur over and over again in the prize list; and though we wish them all success, and hope they will continue to send





in drawings, we are always glad to welcome new competitors, to widen the area, to show that schools in every district of the British Isles and the Colonies are taking an interest in the modern development of drawing.

The "colour" gives a better idea of the standard of work attained, and should enable teachers to make a careful selection of work to be sent in. We do not wish to restrict competition, nor at the same time to be overburdened at this end with drawings that really have no chance of an award. The "commended" work is only a degree below the prize drawings.

Honours this month are awarded to:—

1. Lizzie S. Taylor (16), The Academy, Broughty Ferry.
2. Peter Moffatt (15), The High School, Glasgow.
3. Doris Naylor (13), Wokingham Road Senior School, Reading.
4. R. M'Glashan (15), Wesleyan School, Gillingham, Kent.
5. John Young (14), The High School, Glasgow.
6. Peter Swan (13), Tillmouth Council School.

The work of the following scholars is commended:—

Nancy Capsticks (16), Notre Dame Collegiate School, Everton, Liverpool; Netta Galloway (15), The Academy, Broughty Ferry; Neta Crystal (15), The Academy, Broughty Ferry; Kate Sinclair (15), The Academy, Broughty Ferry; George Leonard (13), Christchurch School, Sparkbrook, Birmingham; C. Davies (12), Christchurch School, Sparkbrook, Birmingham; E. Shepherd (14), Christchurch School, Sparkbrook, Birmingham; Harold Evans (12), Christchurch School, Sparkbrook, Birmingham; Clarice Turner (11), National School, Lightcliffe, Yorks; David Shedden (12), Beith Academy, Ayrshire; Robert Swan (10), Tillmouth Council School; James Craigie (10), Perth Academy.

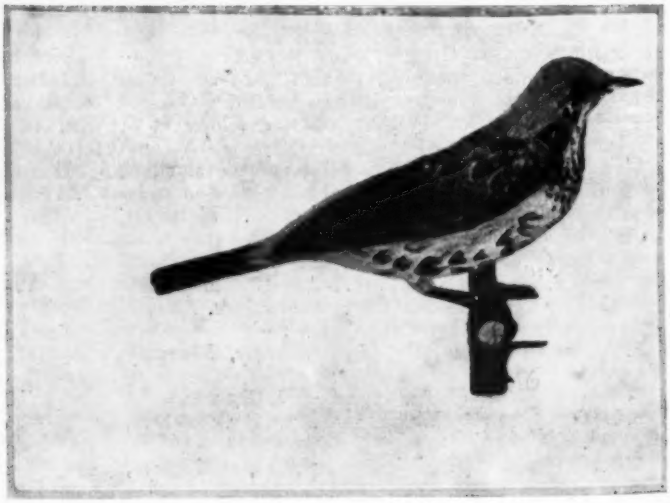
Competitors should not be discouraged if the work sent in is not mentioned for some time. The above list, for instance, contains no drawings sent in since about the middle of December.

Notwithstanding frequent advice to the contrary, drawings still come through the post rolled up instead of packed flat. This minimises their chance of a prize, as it is almost impossible to reproduce these specimens after being creased up.

Drawings may be sent in at any time, addressed to J. Vaughan, 7 Campside Crescent, Langside, Glasgow.

Cardboard Modelling. By A. Sutcliffe. (*George Philip and Son.*)

There is scarcely any necessity to enlarge upon the merits of a book which has reached its third edition. Mr. Sutcliffe is well known as a pioneer of handwork. Perhaps something more might have been done in giving photographic reproductions of completed models, and also in bringing the actual examples themselves more into line with modern ideas of constructive work.



HONOURS PAGE.

NATIONAL APPRENTICESHIP.*

A Significant Change

NO change in the condition of modern employment is more marked than that connected with apprenticeship. The system has fallen into so much disfavour that a most important effect is being exercised by its decline, not only upon the labour market, but, one might rightly say, upon national character. Time was when to be bound apprentice was the natural lot of almost every lad on reaching a suitable age; for a period of seven years he undertook to "put himself apprentice to the master, to serve him faithfully, to keep his secrets, and to obey his lawful commands." As often as not he was taken into the family, and instances were numerous where faithful service secured for the apprentice a share in the business, and even the hand of the daughter of the house. But all that is now changed, to the detriment of the individual and of the entire community.

—And its Cause.

Many causes have contributed to this altered condition of affairs. Marked advance has been made in almost every direction in methods of production. Machinery has very largely replaced handicraft. Trades have become sectional. Whereas years ago a mechanic was able to make a complete article, he is now generally employed in making but a single part of it, the task being left to finishers to piece the various sections together into a composite whole.

The old relations between master and apprentice are completely altered. It is a day wherein the small producer has almost ceased to exist, where large factories have sprung up employing hundreds of men who seldom see, and certainly do not know, the proprietor. The lad no longer sits at the bench with his master, receiving instruction from him, but is handed over to the foreman of a department or to some particular worker from whom he picks up, as best he can, a smattering of the work to which he has been put. These are days of piecework, and the mechanic cannot waste his valuable time in giving instruction to one who is later to become a competitor. Big employers of labour, moreover, will not be bothered with apprentices. They prefer, where they must employ boy-labour, to have lads whom they can dismiss at will. They do not wish to be concerned with imparting instruction. They are producers on a large scale, for foreign competition has proved effective, and has resulted in crushing the small craftsman. There is yet another reason for the decline of apprenticeship: the struggle for existence becomes daily keener, and the earliest opportunity is taken after a boy leaves school of sweeping him into the wage-earning ranks.

Resultant Evils.

The effect of all this is pernicious in the extreme. For a few years he is thrown from pillar to post, filling any occupation which is at hand, and when at last he is so old that he can no longer be engaged as shop-boy or messenger he is undisciplined, unskilled, and unemployable. The training he has received has been the worst possible for his future. As often as not it has been obtained in the streets of large towns, with the inevitable result that the seeds are sown which later fructify and produce the worthless members of the community. By those competent to judge, it is urged that criminal tendencies very largely develop between the ages of fourteen and eighteen, for it is during these years that lads are most susceptible to outside influences; and those engaged in looking after the welfare of youths, therefore, never lose an opportunity of inducing boys to bind themselves as apprentices to some good trade, where, for a period of years, they are under rigorous discipline, which must stand them in good stead in later years.

It hardly matters to what trade the lad is put; the great thing is that he should be apprenticed. Should he later have a predilection for any particular trade, or should he display ability in a direction other than that connected with his form of employment as an apprentice, it will always show itself when he reaches adolescence. The training he receives, even in an occupation he is not destined to follow, will always be valuable to him, no matter the sphere in which his lot may be afterwards cast.

An Important Matter.

Parents are beginning to recognise the importance of the question; and though for a time there was an avowed hostility towards apprenticeship, the system is gradually coming into favour once more. There were good reasons for objection to apprenticeship. The best firms refused to take apprentices, with the result that masters were obtained to whom small premiums were a consideration, and who were frequently financially unstable. The bankruptcy of the employer—by no means a rare occurrence—was the cause of loss of money and loss of time, to say nothing of the unsteadying influence on the boy, whose training was interrupted at the most critical time. Long terms of apprenticeship were the rule, and a boy found after the first year or two there was little left for him to learn. Frequently a lad learned but a section, and that a small one, of the trade to which he had been put. The wages were notoriously low, and the instruction uninteresting and inadequate. But all this might have been avoided had the parents of the boys been more fitted to undertake the apprenticeship of their sons.

Apprenticing Bodies.

Recognising these evils, societies have arisen to combat them. One of these is the National Institution of Apprenticeship. The Lord Mayor of London recently appealed for contributions to enable the council to continue to carry on and extend the work undertaken by this body—that of apprenticing boys and girls to trades in which skill is required. He urged that the value of the association cannot be easily overestimated, especially as it tends to diminish the number of unemployed, who are nearly all unskilled. The institution is philanthropic and non-sectarian, and is under Royal patronage, being administered by a council and several committees.

The council's report for the year 1908 shows that the institution exercises a careful discrimination in the selection of trades and in the general management of boys. The institution has indentured over 630 apprentices to good masters engaged in skilled trades, and these apprenticeships are supervised by the council. The members applying to be apprenticed are continually increasing, and now exceed sixty per week. The society is handicapped by an insufficiency of funds with which to pay premiums, and it is estimated that a sum of

* With acknowledgments to the courtesy of the Editor of the *Daily Telegraph*.

£13,000 would be required during the next twelve months adequately to meet the demands made upon the association. It would be difficult to find a better object to commend to the sympathies of the philanthropically-inclined.

The Jewish community has set a very good example in this particular work; for the industrial department of the Jewish Board of Guardians and the Apprenticeship Committee of the Jews' Hospital and Orphan Asylum have for many years past undertaken the work of finding suitable places for lads, who are apprenticed and supervised until they complete the period covered by the indentures. Premiums are paid, the greatest care is exercised in the selection of masters, guardians are appointed who keep in touch with their *protégés*, lads are encouraged to attend technical schools, periodical visits are paid to workshops, and detailed reports are kept at the offices of the respective institutions of the needs and the progress of each apprentice.

NOTES AND SUGGESTIONS ON THE TEACHING OF EXPERIMENTAL SCIENCE, MATHEMATICS, AND DRAWING.

BY C. HAMILTON.

(*Continued from page 395.*)

Section XXV.

HAVING mastered the construction and use of the thermometer, the class may proceed to ascertain (*a*) whether all solids expand equally through the same range of temperature, and (*b*) whether the rate of expansion is uniform.

The most satisfactory method is to use a tube about a metre long, closed at both ends with flat caps, and fitted near each end with inlet or outlet tubes. The tube stands in a vertical position, with its lower end on a firm support. The upper end just passes through a hole in a shelf on which can rest the three legs of a spherometer. After Examples 9 and 10, Section IV., of the October supplement, the spherometer will need very little explanation.

The tubes may be $\frac{1}{2}$" iron gas-pipe, copper, brass, and glass tubes; and as the experiment only takes a few minutes, the students can pass from one to the other to measure the increase in length.

A metre tube will give an expansion for iron of about 1·2 mm. for 100° C., for brass about 1·9 mm., and for copper about 1·7 mm. As it is only necessary to obtain a result correct to two significant figures, the temperature range will be sufficiently accurate if measured within 10 per cent. There is hardly anything to be gained, therefore, by inserting a thermometer in or jacketing the tube, and the simplest plan is to syphon ice-cold water through the tube, read the spherometer, pass steam through, and read the spherometer again.

All pieces of apparatus in which a lever is used are unsatisfactory, because of the difficulty of measuring the short arm with sufficient accuracy.

The teacher should, if possible, perform another experiment, in which a liquid of lower boiling-point is used, or in which hot water is syphoned through, and the mean temperature of inlet and outlet taken. The result compared with those obtained by the students will show that the expansion per degree is practically constant between 0° C. and 100° C.

The data may be discussed in the following way:—

What is the total increase in length? What is the average increase in length per degree? What increase would have been observed if 1 c.m. only had been used?

Then

$$\frac{\text{increase in length for 1°}}{\text{original length}}$$

is called the coefficient of linear expansion. Is it the same for all the metals, etc., used?

Suppose a rod of metal is exactly 1 foot long at 0° C. What will be the increase in length for 1°, 2°, 3°...$t°$? (at). What would be the increase if the rod were 2′, 3′, 4′...L′ long? (Lat). What is now the total length? ($L + Lat$). Show that this may be written $L(1 + at)$. Calling the length at 0° L_0 and the length at $t°$, L_t, we have $L_t = L_0(1 + at)$.

The above equation is a fearsome thing if it is thrown at the class from behind a lecture table, but it has no terrors for the students who help to make it.

Before proceeding further, it will be desirable to let the class work a few examples, say the first three at the end of this section.

Now draw the attention of the class to the fact that solids expand in all directions, and invite them to consider a square sheet of 1′ side which expands a in length and breadth for 1° C. rise in temperature.

What is the new length of each side? What is the new area? The students should make a sketch, and compare the figure with the expression $1 + 2a + a^2$. If the square were of iron, a would be equal to ·000012. To what would $2a$ and a^2 be equal? Is it worth while taking ·000000000144 into account? Or can it be neglected? Hence $2a$ is approximately the increase in area when a square of unit side is raised through 1°, and the coefficient of superficial expansion is approximately twice the coefficient of linear expansion.

Deal with the expansion of a unit cube in the same way, and illustrate the meaning of the terms in the expression $1 + 3a + 3a^2 + a^3$ by letting the students fit up a cube of edge $1 + a$, using a wooden cube and cardboard to represent the increase in volume.

The conclusion will be drawn that $(1 + a)^3 = 1 + 3a$ when a is small compared with 1, and the relation between the coefficients of linear and cubical expansion will be made clear.

These algebraical approximations are of considerable importance, and it is necessary to guard against the presumption that they rest upon considerations of physical expansion. It will therefore be advisable to ask the class to multiply out $(1 + a)^4$, and then, giving a certain small value to a, to ask them what terms can be neglected if a result is required only to a certain degree of accuracy. They will conclude that for all practical purposes if a is very small $(1 + a)^4 = 1 + 4a$. The class may now multiply out $(1 - a)^2$, $(1 - a)^3$, $(1 - a)^4$, and extend their previous inference to $(1 \pm a)^n = 1 \pm na$.

Using β and γ to represent the coefficients of superficial and cubical expansion, the pupils may arrive at the formulæ—

$$S_t = S_0(1 + \beta t),$$
$$V_t = V_0(1 + \gamma t).$$

The teacher will probably prefer to start his class on some rather simpler examples than those which follow, and which are only given in order to provide practice

in the more important results obtained in this section. Before working some of them, it would be advisable to show the students the following approximations :—

$$\frac{1}{1+x} = 1 - x \text{ and } \frac{1}{1-x} = 1 + x.$$

$$(1 + x)(1 + y) = 1 + x + y.$$

$$(1 + x)(1 - y) = 1 + x - y.$$

$$(1 - x)(1 + y) = 1 - x + y.$$

$$\frac{1+x}{1+y} = (1 + x)(1 - y).$$

EXAMPLES.

1. A bar of iron at 0° measures 300 cm.; what will be its length at 15° C. if the coefficient of linear expansion is ·000012 ?

2. A brass rod is 300 cm. long at 15° C. What will be its length at 0° if the coefficient of linear expansion of brass is ·000019 ?

3. A copper wire is 150 cm. long at 10° C. What will be its length at 0° C., 15° C., and 25° C. if the coefficient of linear expansion of copper is ·000017 ?

4. Calculate the length of the rod in Example 1 when the temperature is 60° F.

5. Calculate the length of the bar in Example 2 when the temperature is 50° F.

6. A wire rectangle is 10 cm. long and 5 cm. wide at 15° C. What will be its length, breadth, and area at 0° and at 25° if it is made (*a*) of iron, (*b*) of brass ?

7. An iron ring (the tyre of a wheel) has a diameter of 200 cm. at 15° C. What will be its diameter at 0° C. and at 500° C. ?

8. By how much will 1 mile of steel rail contract in a temperature falling from 15° C. to −10° C. ?

9. If the ends of the rails of a mile of railway are in contact at 160° F., what will be their distance apart at 12° F. ?

10. What will be the distance apart of two 20-foot lengths of the rails in Example 9 at 50° F. ?

11. In the measuring machine constructed by Sir Joseph Whitworth a length could be measured to one-millionth of an inch. Find what rise in temperature would be required to increase the length of a piece of steel 1′ long at 0° by ·000001″. In using such an instrument, would it be safe to handle the piece to be measured ?

12. A sheet of lead is 30 cm. × 20 cm. at 15° C.; what will be its area at 0° C. and at 70° C.? Coefficient of linear expansion of lead is ·000028.

13. A pane of glass measures 50 cm. by 30 cm. at 15° C. What will it measure at 0° and at 25° C. ? Should such a piece of glass be fitted tightly into the wood frame ? Give reasons. Coefficient of linear expansion of glass = ·0000086.

14. When the glass stopper of a bottle is fast in the neck, it can frequently be loosened by warming the neck. Explain this.

15. A steel metre scale is correct at 0° C. What is its percentage error at the temperature of boiling water ?

16. A rectangular piece of steel is 6″ × 4″ × 2″ at 15° C. What will be its volume at 0° C. and at 25° C. ?

17. Write down the squares and cubes of 1·001, 1·007, ·99, ·98.

18. Write down the value of $(1·003)^5$, $(1·0009)^4$, $(·97)^7$.

19. If a cube of unit edge at 0° C. is constructed of material which has coefficients of expansion *a*, *b*, and *c* in the directions of its length, breadth, and thickness, what is its volume at 1° C., and what is its coefficient of cubical expansion ?

20. Find approximate values of the following—1·002 × 1·003, 1·02 × 1·03, 1·2 × 1·3. Compare the approximate values with the results obtained by multiplication.

21. Find approximately the value of 1008 × 996.

22. Find the approximate value of $\frac{1}{1·009}$, $\frac{1}{98}$, $\frac{1}{506}$.

23. Find approximately the values of $\frac{1·002}{1·003}$, $\frac{·997}{1·002}$.

24. If the area of a rectangle $l \times b$ is calculated from measurements in which l is 2 per cent. too large and b is 1 per cent. too small, what is the error in the calculated area ?

Section XXVI.

The students may now proceed to the study of liquid expansion. It will have been shown in Section XXIII. that liquids expand more rapidly than solids, so that three questions present themselves for investigation. Is the rate of expansion the same for all liquids ? Is the rate of expansion of any one liquid —for example, water—uniform ? And what is the rate of expansion in a particular case ?

The first point may be settled by fitting specific gravity bottles with tubes ground in to form long necks. If these bottles are filled to the same heights with different liquids, and immersed in a vessel of warm water, it will be at once apparent that differences exist similar to those which obtain between solids.

The tubes with ground ends can be purchased, but it is an easy matter to rub the end of the tube down on a piece of emery cloth moistened with turpentine. When it will enter the neck of the bottle the tube should be moistened with powdered emery and turpentine, and rotated until a good fit is secured.

The irregularity of expansion of water may be observed with a similar piece of apparatus. It is, however, advisable to use a narrow bore tube of some length, and to note the increase in length for a given change at, say, 15° to 20° C., and at 60° to 65° C.

The attention of the class may be directed to the possibility of actually measuring the rate of expansion with a piece of apparatus of this kind, and the fact may be elicited that the volume of the glass vessel also increases with the temperature. The relation of absolute to apparent expansion, and to the expansion of the vessel, is not easily understood by many pupils. The experiment given below will, however, make that clear.

A specific gravity bottle * is fitted with a graduated tube ground in the neck. If a 10 c.c. bottle is used, it will be necessary to purchase a graduated tube, or to determine the diameter of a piece of thermometer tubing by measuring and weighing a column of mercury in it. If a bottle of 50 c.c. or 100 c.c. capacity is used, a 1 gm. pipette graduated into $\frac{1}{100}$ gm., which can be purchased from any instrument maker, may be used. Such bottles and graduated tubes are supplied by Mr. Thomas Wyatt, 279 Deansgate, Manchester.

The flask should be filled quite full of water, which has been boiled to free it from air, and the tube is inserted. The flask is then immersed in a bath, which should be comparatively large—say, a tin saucepan—and the height of the column noted at certain temperatures. The temperature of the bath should rise very slowly, as the temperature of the water in the bulb will lag behind that of the bath. As a check on the results, the bath may be allowed to cool, and the heights noted with falling temperatures. While this is going on the students may plot on square paper the expansion of the glass vessel from the known coefficient (Section XXV) of expansion of glass.

The increase in volume of the water at each temperature should then be plotted on the same paper. It will then be clear that the curve of absolute expansion is obtained by *adding* the curve of apparent expansion of the water, and the absolute expansion of the glass vessel.

The expansion of water is given in the following table :—

100 c.c. of water at 0° C. becomes—

		Difference.
At 4°,	99·987	
,, 10°,	100·012	·025 c.c.
,, 20°,	100·161	·149 c.c.
,, 30°,	100·412	·251 c.c.
,, 40°,	100·757	·345 c.c.
,, 50°,	101·181	·424 c.c.
,, 60°,	101·677	·496 c.c.

* A bottle of known volume simplifies the calculation. Apart from this, an ordinary flask will serve the purpose.

While the foregoing experiment is going on, the students, in addition to plotting the curve, may keep under observation an experiment with Hope's apparatus. Before the latter is discussed, they should be asked to calculate the density of a liquid which has expanded, say, 1 per cent. What would be the effect of heating a liquid at one point? Hence explain the circulation of water in a steam boiler, and the heating of buildings by hot water.

The effect of the anomalous expansion of water in nature should be thoroughly discussed. A suitable experiment for individual performance is that which shows that water expands on solidification. All that is required is a test tube fitted with a good cork and a narrow thermometer tube passing through it. About 10 c.c. of water is poured into the test tube, which is then filled with petroleum. The cork is fixed in, and the test tube immersed in ice and salt. The changes in volume are followed by watching the column of petroleum in the narrow tube. This experiment can of course be made quantitative.

Numerical examples on alterations of density with temperature provide excellent practice in the use of logarithms.

The pupils may then be asked to explain the bursting of water pipes in frosty weather, and the disintegration of rocks. One of the great disadvantages of a high degree of porosity in building materials then becomes apparent.

There are other substances in which the increase in volume on solidification is of extreme importance. Thus, iron, bismuth, and antimony expand when poured in a molten condition into a mould, and this enables sharp impressions to be taken.

EXAMPLES.

1. The mean coefficient of cubical expansion of water between 10° C. and 100° C. is ·00043. What will be the volume at 60° of 100 c.c. of water measured at 10° C.?

2. If the coefficient of cubical expansion of mercury be ·00018, what will be the volume of 1 c.c. of mercury at 0° C. when measured at 30° C.?

3. The weight of 1 c.c. of mercury at 0° C. is 13·596 gm. What will be the weight at 15° C.? What will be its density?

4. The volume of 10 gm. of water at 10° C. is 10·00269 c.c., and its volume at 25° C. is 10·02935 c.c. Find the mean coefficient of expansion of water between 10° C. and 25° C.

5. If 100 c.c. of turpentine measured at 0° are raised to 40° C., what is the new volume if the coefficient of expansion is ·00105?

6. The coefficient of cubical expansion of glass is ·000026, and the coefficient of apparent expansion of water in a glass vessel is ·000404. Find the coefficient of absolute expansion of water.

7. 1 c.c. of water at 0° becomes 1·004123 c.c. at 30° C. What is the density of water at 30° C.?

8. The volume of 1 gm. of water at 10° C. is 1·000124 c.c., and at 20° C. it is 1·001615 c.c. Find the mean coefficient of expansion between 10° C. and 20° C.

9. A 50 c.c. flask holds 50 gm. of water at 15°. What weight of water will it hold at 25° C. if the mean coefficient of expansion between these temperatures is ·00014?

10. If 1 c.c. of water at 0° C. weighs 1 gm., and the mean coefficient of cubical expansion of water between 0° and 100° is ·00043, what will be the density of water at 100° C.?

Section XXVII.

The aim of this section is to investigate the expansion of gases. The students should now have a clear notion of the kind of measurements to be made, and it will be a good plan to ask them a week beforehand to consider the question and to suggest forms of apparatus.

A common method is to close one end of a piece of quill tubing, and to enclose a volume of air in this by means of a short column of mercury. The quill is then fixed in a wider tube or jacket, through which ice-cold water or steam can be passed. Attention to two details is essential to success. The air enclosed in the quill tube must be dry, and the quill tube must not be so wide as to permit of the mercury column flattening, and thus failing to enclose the tube. The lengths of the column of air at the higher and lower temperature are measured, and these are proportional to the volumes. The students should be able to obtain their own formula $Vt_\circ = Vo_\circ (1 + \alpha t)$.

A very simple experiment, which gives admirable results, is carried out by using a hard glass or Florence flask (300 c.c. to 500 c.c. capacity), fitted with a rubber stopper, through which passes a short piece of thermometer tubing. This is immersed in a saucepan of boiling water for about ten minutes. The writer uses a saucepan which has a hole about one inch diameter in the middle of the lid, and the handle removed to the side. When the air in the flask can be assumed to have reached the temperature of the bath, the thermometer tubing is closed by means of a rubber tube and a spring clip. The flask is removed from the saucepan, immersed stopper downwards, in a bucket of water containing ice, and the clip opened. The amount of water which enters is measured by pouring it into a measuring vessel, and the total volume of the flask determined in the same way.

If V is the total volume of the flask, and v the volume of water which enters, the class should be asked to state—(1) The total volume of air; (2) the temperature of that volume of air; (3) the final volume of air; (4) the final temperature of the air.

The formula is $\frac{v}{(V - v)(T^\circ - t^\circ)}$ where T° and t° are the initial and final temperatures.

Students sometimes have a little difficulty in calculating their results, because it is contraction, not expansion, that is measured.

They already know that the volume of a gas is affected by the pressure when the temperature is constant, and they have just found how the volume varies with the temperature when the pressure is constant. It will be clear that there are three influences, of which two have been determined, when the third is constant, and it is evidently of interest to inquire how the pressure varies with the temperature when the volume remains constant.

It will be desirable to let each pair of students carry out the experiment; but should the accommodation and equipment not permit of this, the teacher ought certainly to perform it. The ordinary apparatus is a bulb tube, with a bent stem attached to a Boyle's Law apparatus, or to any manometer which will permit of pressure being increased and the increase measured readily.

It may be pointed out that the coefficient of cubical expansion of a gas is ·00365 = $\frac{1}{273}$. If, then, 273 c.c. of a gas at 0° C. are cooled, what will be the volume at − 10° C., −50° C., − 100° C., − 200° C., − 250° C., − 273° C.? This last point is called the absolute zero of temperature, and temperatures measured from it are called absolute temperatures.

The experimental results obtained in this Section may now be dealt with on the lines of those in Section XXII. Thus, in any given mass of gas, $P \propto \frac{1}{V}$, when T is constant, where P is the absolute pressure and T the absolute temperature = 273 + t° C. Again,

$P \propto T$ when V is constant. Therefore when T and V both vary, $P \propto \frac{T}{V}$ and $P = \frac{RT}{V}$ where R is a constant. This gives the general "gas" equation $PV = RT$.

The students may now be warned that their results only furnish evidence for the truth of the law in regard to air, and a distinction should be drawn between vapours and gases.

A few questions will direct attention to the effect of expansion in altering density and in promoting convection currents. The circulation of the atmosphere, the draught of a chimney, and the ventilation of rooms and buildings, may be discussed at greater or less length, according to the needs and interests of the students in attendance.

EXAMPLES.

1. A quantity of air at 0° C. occupies 500 c.c. What will be its volume at 10° C., 50° C., 100° C., 100° F., 180° F.?
2. 750 c.c. of air at 15° C. are cooled to 0° C. What will be the volume?
3. If the air in Example 2 is cooled to − 20° C., what will be the volume?
4. 120 c.c. of air at 20° C. are raised to 70° C. Find the new volume.
5. One litre of air at 0° C. and 760 mm. pressure (normal temperature and pressure, written N.T.P.) weighs 1·293 gm. What will be the weight of a litre of air at 20° C.?
6. What is the weight of air in a room 6 × 5 × 3 metres at 0° C. and at 15° C. when the pressure is 76 cm.?
7. What will be the weight of the air in Example 6 when the barometer stands at (*a*) 74·5 cm., (*b*) 77·2 cm.?
8. At what temperature will a volume V of gas measured at 0° C. be doubled, the pressure remaining constant?
9. At what pressure will the volume V of a gas measured at N.P. be halved, the temperature remaining constant?
10. A chimney is 10 metres high and ·25 metre sectional area. The gases in it may be assumed to have the same density as air. What is the weight of the gases in the chimney when the temperature is 0° C., 10° C., 200° C., 350° C., 500° C.? The density of air is ·001293 gm. per c.c.
11. What is the difference in the weight of the columns of air at 200° C. and at 10° C. in Example 10? What is the force tending to cause "draught" in the chimney, of Example 10, when the mean temperature of the gases is 200° C. and the external temperature is 10° C.?
12. The height of a chimney is *h* cm., the sectional area a sq. cm., the density of the chimney gases at 0° C. is *d*. What is the weight of the chimney gases at 0° and at a mean temperature of 150° C.?
13. Compare the weight in Example 12 with that of the external column of air when the temperature is 15° C.
14. A mass of gas of density *d* at N.T.P. is raised to a temperature T° C. What is the new density d_1?
15. A mass of gas of density *d* at N.T.P. is subjected to an increase of pressure *p*. What is the new density d_1?
16. The volume of a mass of gas is 1000 c.c. under a pressure of 15 lb. per square inch. What will be the volume when the pressure is 14 lb. per square inch?
17. The volume of water passing through a 2″ pipe is 45 gallons per minute. If the water flows twice as fast through a 7″ pipe, how much will flow per minute?
18. The weight of water which a bucket will contain varies directly as the depth, and as the square of the diameter at the top. Write a formula for the capacity of a bucket, using *h* for the depth, *d* for the top diameter, *w* for the weight, and *k* for any constant that may be necessary.
19. If a bucket, as in Example 17, with a 12″ top diameter and 10″ deep, will hold 45 lb. of water, find *k*. Then construct a formula for the weight of water which can be held in any bucket of similar shape.

Notes of Lessons on Arithmetic. Vol. I. By C. W. Crook. (Pitman.)

This book provides an excellent collection of "Notes of Lessons" on elementary mathematics. The scheme is comprehensive in character, and practical geometry, graphs, and mensuration are treated with special fullness and ability. Each lesson begins with an indication of the apparatus required, and then follows an exposition of the new matter, with suggestive oral questions designed to arouse the interest of the class.

MODERN SCIENCE NOTES.

BY J. G. M°INTOSH, B.SC., SECONDARY SCHOOL, GATESHEAD.

IMMIGRATION OF BIRDS.

THE fourth report of the Ornithologists' Club deals with the immigration of birds into this country during the spring of 1908, and their chief movements during the autumn of 1907. We give the gist of the report below:—

"The early part of April 1908 was comparatively fine and dry, but the temperature was slightly below the normal. About the nineteenth the weather broke and became wet and stormy; on the twenty-fourth and twenty-fifth snow fell, and it was exceptionally cold for the time of year. Soon after the beginning of May the weather improved, and continued fairly fine during the remainder of the month.

Arrival of Earlier Migrants later than usual.

"The arrival of our earlier migrants was somewhat later than usual, and although stragglers of the various species arrived about their ordinary time, the main bulk of the birds had not appeared on the nineteenth of April. On the twentieth, however, the immigration commenced in earnest, and on the twenty-sixth birds began to pour in, the greatest numbers arriving on the twenty-ninth, when no less than twenty-five out of the thirty-four specially recorded species arrived in considerable numbers. During the following ten days the immigration continued, and culminated on the ninth of May in another great influx, including nineteen different species. After that date the migration began to wane, only three species being recorded on the twelfth, and a fortnight later it ceased altogether. It will thus be seen that the main tide of immigration in 1908 was of shorter duration than usual, taking place almost entirely between the twenty-sixth of April and the twelfth of May.

"With most species the average period of the migration lasted for about a month. The wheat-ear, however, arrived more or less continuously between the twenty-fifth of March and the twenty-fourth of May; but it must be remembered that the observations on that species refer to the two races, the larger of which breeds in Greenland, and arrives when the immigration of our native race has almost finished.

"The swallow arrived between the seventh of April and the twenty-fifth of May, and the willow-warbler between the tenth of April and the nineteenth of May. The shortest period of immigration was recorded in the case of the wood-warbler, which was first observed on the twenty-ninth of April, and had apparently settled down in its breeding quarters by the eleventh of May."

The species arriving are arranged into four groups according to the area of their arrival into this country:—

A. Species arriving *solely* on the western half of the south coast—Ring-ouzel, house-martin, land-rail.

B. Species arriving along the whole of the south coast, but first and chiefly on the western half—Wheat-ear, whitethroat, blackcap, chiffchaff, willow-warbler, wood-warbler, sedge-warbler, pied fly-catcher, swallow, sand-martin, swift, common sand-piper.

C. Species arriving along the whole of the south coast, but first and chiefly on the eastern half—Whinchat, lesser whitethroat, garden-warbler, grasshopper-

warbler, yellow wagtail, tree-pipit, redbacked shrike, spotted flycatcher, nightjar, cuckoo, turtle-dove.

D. Species arriving on the south-east coast from Essex to Hants—Ring-ouzel, redstart, nightingale, reed-warbler, wryneck.

The ring-ouzel is placed under both routes A and D, as the earlier arrivals, which included our breeding birds, appeared first in the west. After an interval of two or three weeks, another immigration was noted in the south-east; but this latter movement probably consisted of Continental breeding birds, which were merely passing through the country on their way north.

The terns, which arrived simultaneously at their breeding-places on the east and west, have not been included in the above lists, for, on the spring migration at all events, they do not appear to follow the coast very closely. Although they arrive on the east and west, and therefore technically travel by routes A and D, they are obviously not following the same lines as the land birds.

Records of the arrival of the white wagtail in 1908 were so scanty that they were not included under any particular list. The report concludes with a summary of the weather conditions during the time over which the immigration extends:—

"Throughout March the weather was wet, cold, windy, and very unsettled. There was, however, but little mist or fog.

"In April, during the first week, the w ather was changeable and cold, but the rest of the month, though still very cold, was bright and fine. Towards the end of the month Arctic conditions prevailed, culminating in a heavy snowstorm on the twenty-third, twenty-fourth, and twenty-fifth. There were several nights with fog or mist along the shores of the Bay of Biscay and the English Channel.

"The month of May was characterised by warm nights with much mist and fog along our southern and eastern seaboard, as well as along the French and Spanish coasts. During the first week the weather was changeable, often thundery; the second week was fair and fine. There was some thunder during the latter half of the month, but, generally speaking, the days were warm and bright. Light winds from the south or west prevailed during the first half of the month, and from the east or north during the latter half.

"In June, during the first week, the weather was thundery, with much fog and mist."

In connection with the question of bird immigration an interesting point has been raised by Dr. Scharff in a paper read before the Royal Irish Academy. In his opinion there existed a land bridge between North Europe and North America in geological times as recent as the reindeer, and just prior to the appearance of man. The connection was, in his opinion, by way of Iceland and Greenland. The European continent stretched beyond Iceland, with an outlying island north-west of Ireland about the size and latitude of Scotland. Among the reasons cited by him is the fact that sixty-eight species of American birds have been recorded from Europe, while only twenty are known in Ireland, the claim of ten of these as genuine American stragglers being considered doubtful.

A large percentage of the sixty-eight species have been observed in England; but even on the island of Heligoland twelve species of American birds have been noted. From these observations Dr. Scharff concludes that it is evident that the west coast of Ireland is not the region where the American bird first set foot in Europe. Many apparently alight in North Europe after completing their perilous journey across the North Atlantic from Greenland. The number of European bird emigrants to America is smaller, only about seventeen species being known, and these, curiously, have been found in Greenland and Arctic America. Very few have passed southwards to the United States.

The Upper Air.

For some time past the meteorology of the upper air has been under systematic investigation by means of apparatus attached to balloons and kites, and the results have been sufficient to justify a report by the Meteorological Committee. The introduction to the report by Dr. W. N. Shaw of the Meteorological Office gives a historical survey of the work hitherto accomplished in this country. The main body of the report gives a description of the apparatus and methods in use by Mr. Dines at Pyrton Hill, the details relating to the construction and management of kites and balloons being precise enough to afford valuable information to any person desirous of taking part in this department of meteorological work. The results already achieved are interesting, and promise to revolutionise many of the ideas formerly held regarding the movements and changes of the atmosphere.

One of the chief results has been the discovery of a layer of isothermal air. Up to a height of about seven miles there is a steady decrease in temperature, as one might expect, although not at a uniform rate. Beyond that height, and up to the limits which have yet been reached, there is either no perceptible change or there is an inversion of temperature, the instruments for a time showing a distinct rise of the thermometer. The conditions described have been found to exist over all parts of the globe in which experiments have been carried out. Continental observers have discovered that at a great height the temperature of the air is often much colder in equatorial than in polar regions. These and other results of a more technical nature add to our knowledge of the constitution of the atmosphere, and may considerably modify the ideas hitherto held regarding air movements.

Water Vapour in the Atmosphere of Mars.

A considerable amount of controversy has taken place in recent years on the question of the presence or absence of water vapour in the atmosphere of the planet Mars. To prove a negative is a difficult, if not impossible, feat. The recent special researches of Professor Campbell of the Lick Observatory tend to show that the amount of vapour present is not a measurable quantity.

Since the presence of water vapour in our own atmosphere could easily affect the accuracy of the results, Professor Campbell tried to eliminate this as far as possible by ascending to the top of Mount Whitney, 4,420 metres above sea-level. At this level 75 per cent. of the total vapour of our atmosphere was left behind, and though hygrometric observations are uncertain, the whole of the evidence tended to show a small amount of humidity present in the atmosphere of Mars.

The plan adopted was to secure as nearly as possible simultaneous photographs of the spectra of Mars and the moon at approximately equal altitudes. The difference in appearance of the well-known bands at the red end of these spectra would declare the presence or

absence of water vapour. The moon's spectrum was thus made the standard, and the question to be solved was whether the Martian atmosphere exhibited differences which could be explained by the presence of water vapour.

Six spectrograms were taken with various exposures, so that the a band could be thoroughly examined. With Mars at an altitude of 49°, the a band was more strongly impressed than at a less altitude, and when, consequently, the light had to traverse a longer atmospheric path. This result shows that the effect of the terrestrial atmosphere can alter observations, and justified Professor Campbell's selection of a lofty height for his inquiry. In fact, he suggests, in his analysis of former observations, that some of the contradictory results may have been due to the neglect of this disturbing factor.

The examination of the spectrograms shows that the a bands in the Martian and Lunar spectra are very faint, and of quite similar character, and hence that any water vapour existing in the equatorial atmosphere of Mars at the time these observations were made was too slight to be detected by present spectographic methods. Considering that the rays photographed had traversed the Martian atmosphere twice, it is safe to conclude that the quantity of vapour on the planet did not exceed the quantity of terrestrial vapour above Mount Whitney.

This conclusion raises a serious difficulty concerning the so-called polar snow-caps of Mars, which are observed to wax and wane according to the season. If they are snow-caps, they point clearly to the presence of water, and therefore of water vapour. Professor Campbell, however, points out that there is no reason why these polar caps should not have a carbon-dioxide constitution. On the whole the inquiry tends to emphasise strongly our imperfect knowledge of the planet, and the corresponding need for the cautious acceptance of startling theory.

Apropos of the foregoing, Professor Miethe has been devoting time to the calculation of the amount of energy that would be required to signal to Mars sufficiently clearly to attract the attention of its presumed inhabitants. To signal electrically, he says, would require a generating machine many millions of times as strong as anything in use on the earth. A light signal to be seen with the naked human eye on Mars would have to be 4×10^{12} candle power. If, however, the Martians had a telescope of ten thousand magnification, the light signal need only be 36×10^{7} candle power. To work such a lamp would cost £900 per hour. To illuminate a geometrical symbol would require an area of twenty thousand square kilometres.

On the other hand, Tesla claims that with his present plant he could reach a rate of 10^{9} horse-power energy delivery, and that with such an intensity he could produce perceptible electrical effects on delicate instruments placed on Mars.

Number Primer. By M. A. Bailey and G. B. Germann. (American Book Company.)

Here we have an excellent specimen of an arithmetic primer published by an American firm. The number exercises are well adapted, both as to substance and mode of expression, to the understanding of the pupils at the very commencement of their work. The characteristic features are the carefully graded exercises and the beautiful illustrations. The book is well worth the perusal of teachers of infants' departments and all young teachers.

GEOGRAPHY NOTES UP-TO-DATE.

BY E. B. WETHEY, M.A., F.R.G.S.

Correlation of History and Geography.

THERE is much talk at the present time of the correlation that ought to exist in the teaching of these two subjects. Historical conferences broach the subject, geographical conferences always discuss it, general educational conferences assign it a place in their programmes. The air is thick with the "talk," and that appears to be all. The average history teacher still plods along his stereotyped course, ignoring the influence geography has exercised, and is exercising, on his subject. The average geography teacher still fails to drive home the points of his lesson by a reference to historical events, which partly owe their existence to the very "points" he is teaching. Both are shut up, as it were, in water-tight compartments. Both fail to make use of valuable material lying ready to their hands. To a certain extent the writers of history and geography text-books are to blame. They do not ignore the correlation perhaps as much as they did, though a really good orographical sketch map is still a rarity in a school history. It is the demand, however, that is at fault. It is too faint to create the supply. And yet there are some good books for the teacher who is sufficiently broadminded to correlate the two subjects. At the risk of appearing invidious we might cite George's *Relations of Geography and History* (Clarendon Press) for the seniors, Dann's *Historical Geography on a Regional Basis* (Dent) for the middle school, and Mackinder's *Elementary Studies in Geography* (Philip) for the juniors. Nowhere is the importance of the subject better emphasised than in the opening words of the preface to the first of these three works:—"Every reader of history is aware that he must learn some geography if he would understand what he reads. Comparatively few, however, if one may judge from experience, seem to realise how much light geography throws on history. Geographical influences account for much that happens or has happened. Geographical knowledge affords valuable data for solving historical problems. At the same time human action alters the aspect of those things of which geography takes cognisance: man cuts canals and tunnels mountains, drains marshes and constructs artificial harbours, though it must be admitted that these things are trifles compared to the steady operation of geographical causes all history through."

Geography and World History.

To take an example of this correlation, the whole world history may be divided into three great time periods, each of which is based on what may be termed a geographic influence. Set it down in tabular form:—

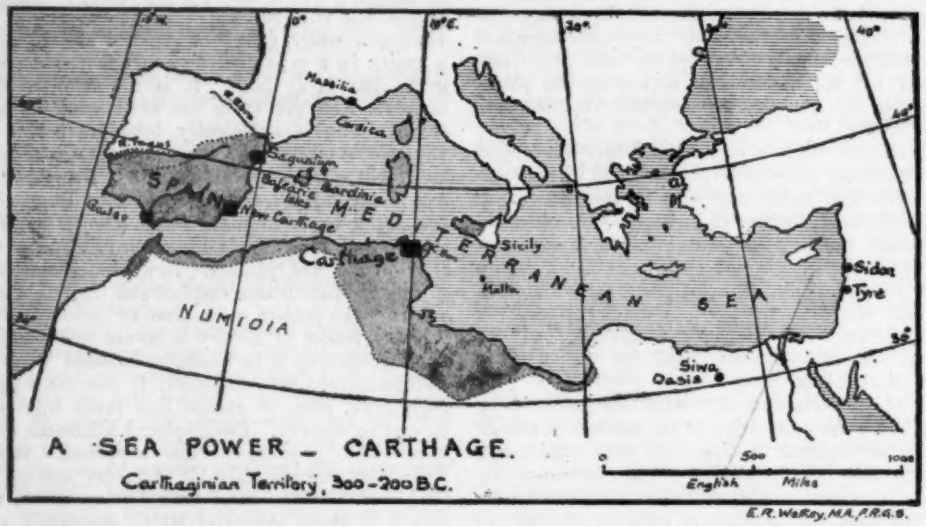
The *River* Age to 800 B.C.	The *Sea* Age, 800 B.C.–15th Century A.D.	The *Ocean* Age, 15th Century onwards.
Tigris. Euphrates. Ganges.	Phœnicians. Carthaginians. Greeks.	Portugal. Spain. Netherlands.
Yangtse-Kiang. Hwang-ho. Nile.	Romans. Italian republics. (Amalfi, Pisa, Lucca, Florence, Genoa, Milan, Venice.)	France. United Kingdom. United States. Germany.

The table is full of lessons. Fear of the sea, above all,

of the open ocean, restricted the trading communities of early times to the great river valleys, beyond and around which there was no inducement to wander. The river itself was veritably the cause of their existence. Egypt, which boasts a continuous history to 5000 B.C., and a prehistoric age of continuous agriculture to 7000 B.C., is a first-class example. "The Nile is Egypt, and Egypt is the Nile" is patent. Every inch of fertile soil in Egypt proper has been brought down by the Nile. The whole country is practically only half as large again as Wales, for away from the Nile it is uninhabitable.

The time came when with better and larger boats the fear of the sea began to diminish. Then was the opportunity—the geographical opportunity—for the great central sea of the ancients, the Mediterranean. A whole series of world-historical peoples arose, sometimes overlapping chronologically, sometimes in due succession, around its shores. The Phœnicians were the first. From a small territory only thirty miles long and one mile broad—or, if some scattered territories to the north and south be included, at most 120 by 12 miles—they ruled the sea, and sent their ships all over the then known world. Timber from their own hill slopes of Lebanon, silver from their Spanish settlements, tin from the Scilly Isles, amber from the Baltic, were among their assets of trade. They are said, indeed, to have rounded the Cape of Good Hope two thousand years before Vasco da Gama. They were followed by one of their own "factories," Carthage, whose geographical position coloured the whole course of its history. Its central and prominent peninsula enabled it gradually to claim the overlordship of the whole of the Western Mediterranean. The map of its dominions shows how substantial these claims were, and how essential it was that for continued progress it should develop as a "sea power." When the Romans were ready to try conclusions with their formidable antagonist they found they had to deal with three great bases:—(1) Carthage itself and the whole North African shore from opposite Italy to outside the Pillars of Hercules; (2) the southern half of Spain, a natural legacy, of course, from Phœnicia; (3) all the islands—namely, the Balearics, Corsica, Sardinia, Malta, and the western half of Sicily. No trader was allowed beyond the Hermœum Promontory (Cape Bon) under penalty of death by drowning. The ultimate course of events is well known. The Romans beat Carthage as Kitchener won Omdurman—by overcoming geography. Geography was the chief obstacle in the way of ultimate victory—in the one case the sea, in the other the desert; and once that obstacle was surmounted there was but one end to the contest. With the loss of her sea advantages Carthage fell.

Space will not admit of more than a passing notice of the other historical nations in the table. Suffice it that the last of the great Italian republics, Venice, was ruined not so much through the formation of a League of Cambrai as through the advent of a new geographical era. The discoveries associated with the names of Columbus, Da Gama, and their followers shifted the world's commercial centre. The Atlantic superseded the Mediterranean as the hub of the maritime universe. The coming of the Turks—in itself an interesting geographic influence—shut out the old trade routes to the East. The rise of the great Western States—of Spain and France, followed by Holland and Great Britain, and in much later times by the United States and Germany—was a natural consequence. It has been well said in our own case that the year 1492 is the most momentous event in English history. Up to then these islands were *ultima Thule*, on the outermost edge of civilisation. Within a few decades after the discovery of the New World, Great Britain had become a maritime and colonising power of the first class, well in the centre of the political and commercial world. Its history, in other words, followed the natural course marked out for it by geography.



Some Common Mistakes in Examinations.

In the course of a year I look through some thousands of examination papers in geography. It has occurred to me that teachers might from time to time like to see the sort of mistakes which never die. I do not refer to the ordinary muddle-headed "howler," such as, "A prairie is the kind of forest where the land is very barren, and only grass can be grown, as in the Sahara Desert," wherein a recent examinee crowded into his

solitary sentence as many errors and contradictions as he possibly could, but to the mistakes which arise partly from faulty or antiquated text-books, and partly from a slight tendency to carelessness in the teaching. Whatever the cause, the following samples are always turning up. They are up-to-date, for they come from a public examination of Christmas 1909.

The Gulf Stream in far the majority of papers still appears as a broad current washing up against the shores of Western Europe, and exercising all its mythical influence on our wonderful British climate. And yet recent and easily accessible text-books* make the matter perfectly clear. The Gulf Stream never reaches the shores of Europe. It dies out, both in set and temperature, as far off as the longitude of Newfoundland, or some 1,500 miles away from Europe.

Panama is always cited as an example of an ultra-malarial and death-dealing climate. "Every sleeper of the Panama railway cost a human life" is the quotation which clinches matters. This was, of course, true enough some five or six years ago. It is very far from being the case now. Science in the hands of an enlightened American executive has almost turned the "canal zone" into a "health resort." Anyway, the European death-rate now is a mere 16 per 1,000, which will compare favourably with most towns in the British Isles. "Atolls are the work of the coral insect"—that everlasting *insect* which one can imagine buzzing round the great barrier reef itself. As well call a jelly-fish an insect. "The Western and Eastern Gats" (Ghats, Ghauts, Gots, Ghots, Gorts—an examiner has to allow a wide latitude in the spelling of geographical names!) "enclose the *plain* of the Deccan." This is a statement one almost invariably meets with in any question involving the division of India into highlands and lowlands. And on the subject of India it is curious how the old spellings maintain their ground. *Hindoo* and *Burmah*, *Taptee* and *Cashmere*, though scarcely to be accounted mistakes, hardly synchronise with up-to-date text-books; and yet they are everywhere amongst the answers. Again, too, though every teacher, we imagine, is always fighting against it, the modern boy and girl use "top and bottom," "over and under" more often than not when "north and south" are meant. "To reach Calcutta the ship goes *under* Ceylon" might just possibly be passed; but unless the examiner has a very keen sense of humour he must draw the line at "There are several important towns at *the bottom of* Lake Erie." It is astonishing to read how many of the generation now grown up think that the development of *civilisation* in China, Japan, and India is owing to—missionaries! Good men enough, of course; but even they would recognise some limit to their influence in this direction. "Alluvial" land is often explained as land which contains gold, silver, lead, and other minerals—a constantly recurring confusion probably due to some unexplained note in the text-book on "alluvial deposits." "Dip of strata" ought not to lead to muddle-headedness; but it does, and various types of "faults" or "folds" are usually cited in illustration of the term. A similar trait of muddle-headedness in the matter of cause and effect invariably gives as the answer to "How is it that the river X and not the river Y has become a busy river?" "Because the towns A and B have been built on the river X." Finally, one is constrained to ask, Will the time never come when the ordinary youthful candidate for a certificate will see nothing memorable in Dundee but marmalade, nothing notorious in Barcelona but nuts?

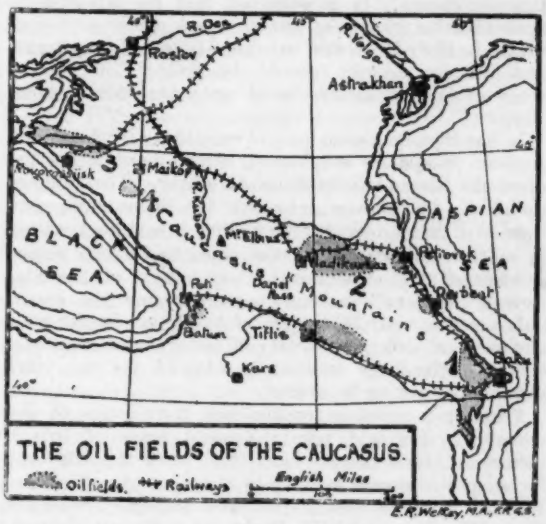
* Compare Huxley and Gregory's *Physiography* (Macmillan), Professor Gregory's *Geography—Structural, Physical, and Comparative* (Blackie) See also *Practical Teacher*, June 1908.

Russian Petroleum—A New Field.

A new oil-field in the Caucasus has just been announced. If its future output at all fulfils the initial promise, its geographical position assumes an importance which is worth noting. Of the numerous wells which are to be found on both sides of the Caucasus Mountains, three districts up to now have been specially prominent. They are numbered on the map:—

1. Baku (far away the most important); 2. Grosni; 3. Illski.

The new one, No. 4, occurs halfway between Maikop and the sea, and appears therefore to be a continuation of No. 3. A glance at the map shows how favourably it is situated. Baku is between five hundred and six hundred miles away from the Black Sea, which, of course,



is its avenue to the petroleum markets of the world. The new "Maikop" field is only fifty miles off. It has been long known that the oil was there. Natives have dug for it with shallow shafts, and have used the product to grease their cart axles. Now the Russian Government has been surveying the district *geologically*, which should save blunders such as are reputed to have lost thousands of roubles in developing the Illski district (No. 3). Up to the end of 1909 not much had been done commercially. One drill "struck" oil at less than three hundred feet down, and a flow gushed out at three thousand tons a day. "The fountain was so unexpected," writes a special correspondent in the *Times*, "that many thousands of tons flowed to waste down the rivers before the well was plugged, as was only done many days after the gusher had caught fire, and had converted the thickly wooded hillside into a raging furnace. Now.....a steady stream of oil is issuing between the columns of the casing, and is being collected in open storages roughly made by damming up the valley in several places."

(To be continued.)

The Senior Curriculum.

BY JOHN PERKINS.

(*Continued from page 344.*)

Training the Citizen.

IF history and civics, moral and religious instruction, are to make any direct appeal, they must be centred round the development of true citizenship. Too often the Scripture lessons have been given with regard only to the demands of the authorised syllabus, and with little attention to their practical value in developing the moral sense and in training that side of the individual which will be called into play in the larger life of the world outside the school.

The senior children are old enough to appreciate the practical every-day application of the truths contained in the Bible narrative, and to get the utmost from them we must make definite endeavour to base our moral instruction—whether incidental or not—upon this foundation. It is admitted that we can find no such valuable history of human development as is contained in Holy Writ, and our discussions upon mediæval and modern history should be welded on to the study of ancient history based upon the stories of the Bible.

In the history lessons proper only those incidents and customs should be emphasised which have a bearing upon the life and institutions of to-day. The children should be led to study history for themselves; but there will be a difficulty in finding a text-book suited in matter and manner to the capacities of the senior children of the elementary school. Most of the historical "readers"—hateful name—obscure the essentials amid a veritable jungle of padding. So far as I am aware a book presenting *real* history, and especially civics, in language and style adapted to our older scholars has yet to be written.

Framing a syllabus for the last three years of the school life, I should take the usual range of British history in the first two years, and leave the last year for a special course in Empire history and citizenship. For this purpose among the most suitable books are Parts IV.*a*, V.*a*, and VIII. *Highroads of History* (Nelson). It will be necessary for the teacher to amplify and to crystallise and to exercise a wise discretion in his selection of passages for self-study. The children should take notes, and make reference to a personally constructed chronological chart in the shape of a line of time. There will also be scope for illustrative work in drawing and modelling, and if visits to places of historical interest are arranged, much valuable work may be done in this direction by making rough sketches on the spot to be developed later at home or at school.

Literature may be profitably associated with the studies, and for suitable material reference may be made to Chapter XII. *Lingua Materna* (E. Arnold), to Bowen's *Catalogue of Historical Novels*, and to the recently published London County Council report on the *Teaching of English* (King). Among volumes of historical poems *The Call of the Homeland* (Blackie) and *Ballads of British History* (Nelson) will be found of value.

A discriminating use of the anniversaries of great events and the treatment of important matters of current interest will serve to give life to the work, and a monthly discussion for the oldest scholars on some previously arranged topic will assist in the correction of any erroneous notions which the children may have acquired.

Such a course will demand wide reading on the part of the teacher, and, if possible, the work should be given to one who has a special aptitude and liking for the subject.

Geography and Nature Study.

If the study of geography has not ceased to be a mere feat of memory—the absorption of uninteresting facts to be disgorged at will—it is not for lack of exponents of a better way. The geography lesson must be approached in a scientific spirit. Economic and political conditions depend almost solely upon natural causes. Consequently sound geographical knowledge must be founded upon a course of nature study which will inquire into those geological, astronomical, and meteorological laws which have resulted in the present-day distribution of the human race and of the industries by which the race is supported.

There must be first-hand observation of such matters as the effect of air and water upon soil formations (weathering), the influence of soils upon plant and animal life, the conditions resulting from varying directions of wind, the influence of contour and land slope, and the changes caused by temperature, rain, and sunlight.

Observations and experiments on these lines must go hand in hand with the study of geography proper. In the first place, world geography should be attacked broadly upon the regional method, and, a sound foundation having been laid, political and economic details may be dealt with, commencing with the home land and broadening out to take in the essentials connected with the British dominions beyond the seas, and last of all the remaining great countries and empires.

Independent inquiry and self-study should be fostered at every stage. The text-book difficulty will be a real one. There is not much to choose between the ordinary geographical readers, but the new series by Mackinder, issued by Philips, and the *New Outlook Geography* (Harrap), are conceived on sound lines. The *Comparative Geography*, by L'Estrange (Philip), issued in six parts, is drawn up on an excellent plan, and the better circumstanced schools would do well to adopt them. In any case the geography teacher must have a copy, as well as one of each of the series of Scientific Geographies by Heaton (Ralph Holland), and *The Practical Geography* by Unstead (Clarendon Press). Armed with these it should be easy to evolve a course of geography on sane lines. The children will need a good atlas—Philip's *Atlas of Comparative Geography* is excellent. A series of practical exercises, full of interest and fascination, suitable for home work, may be drawn from the books recommended, and should form a fundamental part of any satisfactory scheme.

The Science of Number and Physical Measurement.

The arithmetic of the past has been chiefly associated with the mechanical manipulation of unwieldy numbers, juggling with complicated and elaborate fractions, and practice in obsolete and useless rules, such as

practice, rule of three, and cube root. There are not wanting institutions in which the old arithmetic syllabuses still hold the field. Teachers—and inspectors too—cling to these antiquated systems because their results are easily tested and tabulated. The arithmetic of the old Code schedules cannot be justified either from the utilitarian or the educational standpoint—it is of little practical value in after-life, and provides little mental training, although it may give scope for mental gymnastics which deceive the uninitiated.

The exercises should be concrete and practical, they should be associated with drawing, and should deal with such amounts and such measures as come within the ordinary experience. It should now be possible to proceed with ratio and proportion as an expansion of the idea of fractions, the decimalisation of money, the metric system of money and measures, the principles of logarithms, the study of algebra as symbolised arithmetic, exercises in geometry as graphic arithmetic, practice in the formulæ and tables used in workshops and offices, and the mensuration of areas and solids. As a rule the examples should relate to data previously ascertained by the children. Exercises in paper and cardboard work will be required to establish principles and to give realisation to the problems propounded, and paper mounting will be a valuable aid in demonstrating geometrical truths.

The arithmetic may be given a definitely practical bent if it is pieced on to exercises in measurement, weighing, and other quantitative work in elementary science. Work of such a character may include averages, densities and specific gravities, thermometric and barometric measurements, comparison of English and metric units, measurement of force and weight, the law of Archimedes, the laws of expansion, and other elementary physical principles which must form the basis of any course in science or technology.

To give effect to this practical work a certain amount of inexpensive apparatus will be necessary, but there need be no anxiety to provide anything in the nature of an ordinary laboratory equipment. A spare blackboard or a specially constructed table top—such as is ordinarily used on trestles—may be slung across the scholars' desks, and many useful experiments worked thereon by the scholars themselves. Then if it is possible to get a small carpenter's bench, in place of the ordinary teacher's desk or table, it will be easy to make simple pieces of physical apparatus.

The scholars should be provided with suitable books of exercises. Among the best are Longmans' *Practical Arithmetics*, Consterdine and Barnes's *Practical Arithmetic* (J. Murray), and Leonard's *Practical Physics* (J. Murray). The two last named contain useful lists of suitable apparatus. The teacher should also consult the discussions of the Educational Section of the British Association, especially those of 1906, dealing with arithmetic, and those of 1908, treating of the teaching of elementary science.

(*To be continued.*)

In the Open Air. By J. Eaton Feasey. (*Pitman.*)

This is a series of outdoor lessons in arithmetic, mensuration, geometry, etc., for primary and secondary schools. It is, indeed, most helpful and suggestive, and is designed to assist the teacher to make his instruction in arithmetic as realistic as possible. Many of the methods adapted are quite new, and the book should find a place on every teacher's shelf.

REFORM IN THE GEOGRAPHY SYLLABUS OF THE PRIMARY SCHOOL.

BY C. BIRCHENOUGH, THE UNIVERSITY, SHEFFIELD.

THE writer of an article entitled "Geography in the Lower Standards," which appeared in the August number of the *Practical Teacher*, calls attention to the unsatisfactoriness of a majority of the geography syllabuses still to be met with in schools. While embodying a protest on behalf of all thinking teachers against the formalism that has for so many years overtaken a good deal of the work in primary schools, the article is of particular interest in showing that some teachers at least are alive to a phase of present-day educational method that occasions the thinking observer considerable uneasiness—a growing tendency to an over-adult view of the reasoning powers and mental calibre of school children.

Thus the author points out that while in many schools the old definitions and the drawing of plans of classrooms still form the staple diet in geography of children in Standards I. and II., to be followed in Standards III. and IV. by a condensed and highly indigestible account of the geography of Britain and the Colonies, and by a still more unpalatable description of Europe in Standard V., in others, aiming at newer methods, a much more objectionable syllabus is often met with, according to which the children in the lowest classes are expected to study "the work and use of rivers," "the layers forming the crust of the earth," "the effects of structure on coal deposits," and so on.

In a protest against the "drybones" of the one and the over-ambitious "abstractions" of the other, a revised scheme was put forward, which, as the present writer understands it, is roughly as follows: Standards I., II., and III.—Life and scenery in foreign lands (geographical features are introduced incidentally, the whole closing with a simple account of the geography of England towards the end of the third year); Standards IV. and V.—The British possessions; Standard VI.—The British Isles, studied with due regard to cause and effect; Standard VII.—"A more advanced study of England, and a more detailed study, mainly from a political standpoint, of foreign countries."

In view of the present activity in the domain of method in the teaching of geography, it may not be without interest to set aside for a moment all *à priori* theorising about the composition of syllabuses, and to examine the forces at work that have given rise to the present unrest; and in so doing, to see what efforts have been made of recent years to devise a satisfactory geography syllabus.

Geography is no new subject. In some form or other it has, from a very early period, found a place in the curriculum of a general education. Thus, in Greek times stress was laid on teaching the second book of Homer, containing the catalogue of the ships, and a brief mention of the geography and history of the Greek tribes that took part in the Trojan war. In the Middle Ages geography was included in the Quadrivium under the head of geometry, and so on. Even as a science it dates back for more than two thousand years. Exact methods of study were introduced into it by Eratosthenes; and we find Strabo, in the first century B.C., criticising the methods of the "ancient geographers" and emphasising the need of observation. It

was Strabo who, recognising the irksomeness of mere memorising, commended the use of fables and myth to animate the teaching of geography and to supplement description. Later on, during the Dark Ages, all attempt at observation and scientific treatment was abandoned, and superstition and myth alone held the field until Western Europe was awakened by the great geographical discoveries of the fifteenth century.

Modern geography owes its development to Humboldt and the evolutionary theories of the nineteenth century. It is no mere description of the earth in the popular usage of this term; rather, it has become essentially a study of man in the world, of action and reaction between man and nature. This is the idea that animates the teaching of the so-called "new geography." Failure to understand this is the cause of much diffused effort, or many overburdened syllabuses, and a good deal of aimless teaching. "If we bear in mind that man is the centre, the converging point, of the science, that all its investigations must have ultimate reference to humanity, there will be no danger of including too much within the field of the subject, of encroaching upon what is strictly the sphere of some other department of science." With such an idea in mind, a study of geography, of climatology, of physiography has a new meaning, and historical geography and the much misunderstood commercial geography are dry bones no longer, but studies of absorbing interest full of latent possibilities.

In the absence of some such guiding idea, it is perhaps natural that all geographical data should tend to be viewed as equally important. Thus it is that teachers and text-book writers in all ages have been in danger of regarding the study of geography as synonymous with the learning of a maximum of very miscellaneous information about the world. Explanation, then, seems unnecessary; the facts are all important, and to make way for them, the descriptive and even the mythical treatment is gradually cut down until the content and method of books like Hübner's *Questions* (1693) becomes the fashion of the manuals.

"1. What is the position of Portugal?

"As to Germany, it lies toward the west, and in its region it is the most western country of Europe. It is bounded on the west by the Atlantic Ocean, and on the east by the Spanish provinces.

"2. What are the rivers of Portugal?

"The Duro above, the Tagus in the middle, and the Guadiana below.

"3. What are the places in Portugal to be noted?

"Lisbon, the capital city of the whole kingdom and the residence of the king, lies at the mouth of the Tagus. Evora lies inland, and is a good fortress. Braga has the archbishop.

"4. Is there anything else about Portugal which it is necessary to know?

"The country is mountainous and has need of grain. The people are mainly merchants. They are Catholics; yet there are many Jews there. The whole country is ruled by one king."

Nathaniel Dwight's *Geography* (1795) followed a similar method.

"*Q.* Are there any lakes in Scotland?

"*A.* There are many, but two are very remarkable. One near Lochness is on the top of a hill almost two miles high. This lake is small, but it has never been sounded, nor does it ever freeze. About seventeen miles distant is another lake which is frozen all the year.

"*Q.* What are the customs and diversions of the Irish?

"*A.* There are a few customs existing in Ireland peculiar to this country. These are their funeral howlings and presenting corpses in the streets to excite the charity of strangers, their convivial meetings on Sunday and dancing to bagpipes, which are usually attended with quarrelling."

The value of rhyme in aiding the memory has not been overlooked, and so we find that in some books geographic information was presented, as far as possible, in verse, to be memorised, oftentimes without reference to even the simplest map.

"America (our native) streams
Shall first awhile become our themes,
Both lakes and rivers, great and small,
Which in th' Atlantic Ocean fall.

* * * * *

"An island is well known to fame,
Manhattan is this island's name;
On sou'-west end New York doth stand,
Investing all that point of land.
Not fully regular it's plann'd,
Yet very elegant and grand.

"For pleasantness, it is agreed,
And health, few places this exceed.
In summer come on every side
The cooling breezes from the tide.
For winter mildness, few excel
This city of same parallel."

Coming nearer home, and in view of what has been said, the method of teaching geography recommended in *The British and Foreign Society's Manual* (1834) is interesting. The monitor stands, book in hand, before a key-map. Each child has drawn an outline of the map on his slate, and fills in each name as the monitor reads from the key-book. The Holy Land is being studied. Tyre is the next point of interest.

"*M.* Where is it?
"*P.* On an island.
"*M.* Describe the situation of the island.
"*P.* It is at the eastern extremity of the Levant, opposite the northern part of the Holy Land, from which it is separated by a narrow strait.
"*M.* What occasioned its erection on an island?
"*P.* Its being attacked by Nebuchadnezzar.
"*M.* In what tribe was it included?
"*P.* Asshur.
"*M.* For what was it remarkable?
"*P.* Commercial prosperity.
"*M.* By whom was the second Tyre taken?
"*P.* Alexander the Great.
"*M.* Cite a passage of Scripture relating to that event.
"*P.* Isaiah xxiii."

And so on.

It was against teaching of this kind that Rousseau protested. He considered the beginnings of geography lie in observational nature study and in the study of the home district. "You wish to teach this child geography, and you go in search of globes, spheres, and maps. What machines! Why all these representations? Why not begin by showing him the object itself, so that he may know, at least, what you are talking about?

"Emile's first two starting-points in geography will be the city where he lives and the country-seat of his father. After these will come the intermediate places, then the neighbouring rivers, and lastly, the observation of the sun and the manner of finding one's way. This is the point of reunion. Let him make for himself a map of all this. This map will be very simple, and composed, at first, of only two objects; but to these he will gradually add the others as he ascertains or estimates their distance and position. You already see what advantages we have procured for him in advance by causing him to use his eyes for a compass."

(*To be continued.*)

Papers for Teachers of Infants.

A TALE FOR THE STORY HOUR.

AN APPLE PIE.

BY LILY FRITH.

ONCE a year, in the glorious month of September, Mother M made a pie. It was always an apple pie, always just the same shape and size, and the same people always came to eat it.

Mother M made this pie for her relations. She was one of a very large family; there were twenty-five of her brothers and sisters, all grown to the same height as herself. They were a very friendly family; they scarcely ever quarrelled, except when the twins I and J got discontented because they were so much alike, and people mistook one for the other. All things considered, they had a very happy time, and liked nothing better than to meet each other, even if it were only on the page of a book.

This annual pie was anticipated by them all with feelings of delight, because on that day they each stood before the word they liked best, and did as that word bade them do.

A week before the pie was needed Mother M began her preparations. She sent all her children, the baby m's, running hither and thither through the orchards gathering stray apples, which big people had passed over. If the baby m's had not had three legs, I don't think enough fruit would ever have been gathered; for each time they returned Mother M just said, "More," and sent them off again.

The apples being gathered, the next thing was to peel them, and for that the wee m's were needed again. They were busy in this way for two whole days, and at the end of that time had a tremendous tub of apples peeled, cored, and quartered ready to show their mother. Then she bade them run and hide, as she needed to be very quiet indeed while she made the crust.

When the week was up the pie was complete. It was baked a lovely brown; and round the edges were tiny straight marks, which Mother M had made by walking round the edge before it was baked, and stamping first with one foot, then with the other, as she walked.

The great day came. The little m's, with their Mother, sat round the room, trying to keep still and be patient. They found it very hard to do either, for somehow when fun is coming it makes you all "movey" and restless beforehand.

There was a knock at the door. Mother M hastened to open it, and in walked her sister A.

A was *very* proud. She was the one who first thought of the apple pie, and because of this always considered it hers, though M made it. She walked up to the pie, climbed the dish, and strolled across the crust to the middle of it, where she stood, very stately and still, waiting for the others. L and N, two very lady-like letters, came quietly in together: N just nodded a greeting to the pie; while L gently said how very nice it looked, and how much she liked it. Little m's always considered this part of the proceedings "slow," and were eager for their more energetic relations to arrive.

O and P came shortly after, full of curiosity. O lifted up the "lid," and P peeped in. Then they went away, nodding their heads and looking very wisely at each other. The babies just caught the word "apples" as they passed, and as they had had nothing to laugh at before, they laughed at that. The fun was really beginning now, however, and they soon had plenty more to laugh at. C and D rushed in together in the wildest spirits; D danced round and round, hopped on the top, nearly upset stately A, and only stopped when he saw C come with a sharp knife, for fear he should be cut instead of the pie.

There was a sudden scramble near the door, and F, G, and H tumbled in together. It was quite evident they were fighting, and, as I dare say you have guessed, F *fought* the hardest; but G *got* the pie, and handed it over to H, who quickly hid it by calling all the little m's to sit round the edge. I and J, who had just had one of their little quarrels, walked in, followed by K, who was also feeling rather cross.

They always were in this mood on pie day; they thought it suited them. As soon as they appeared the little m's jumped off the pie, and ran out of the way. I upset a pot of ink, which he had brought with him purposely; J jumped on the crust, and, of course, spoiled the look of it; K spoiled it still more by a fierce kick which he gave it, and, besides, nearly smashed the dish.

B was very hungry, so without speaking to any one he marched straight up to the pie and bit out a large piece. R had run across from his house, and S had stuck a sharp needle into the crust, but Q came and drove them both away while she cut it up into quarters. She divided one quarter between X, Y, and Z; but W, who wanted the whole of the pie for himself, was served, as greedy folk often are, with none at all.

U and V came and viewed it, but went away without saying anything; they were neither of them good talkers. T was a very determined brother; he said everybody should have done with the pie by this time, and he had come to take it away, which he promptly did.

E followed him; she meant to eat it, or what was left of it, when he wasn't looking. You wouldn't have thought E was so cunning, would you? But, you see, you never can tell by looks.

TO HEAD TEACHERS.

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TUTORIAL COLUMN FOR THE ELEMENTARY CERTIFICATE OF THE NATIONAL FROEBEL UNION.

INTRODUCTORY.

THE following questions have been set in previous years at the National Froebel Union Examinations. These are held regularly in London, Bedford, Belfast, Blackburn, Bradford, Bristol, Cardiff, Cheltenham, Darlington, Liverpool, Manchester, Newport (Mon.), Plymouth, and Sheffield.

The written portion is held annually in the month of July.

The practical portion is held annually at convenient times from May to July.

1. *Knowledge of Child Nature.*

(1.) Give illustrations of the various means which may be judiciously employed to train the senses during early childhood.

(2.) What instinctive tendencies are conspicuously active in children from three to seven? Show, briefly, how you propose to gratify and cultivate these in the kindergarten.

(3.) What obstacles are presented by town life to the desirable gratification of the natural instincts? Can these be overcome?

(4.) To what degree should a child's sense of taste be gratified in its daily diet, or its idiosyncrasies considered? Give reasons for your answers.

2. *Practice of Education in Kindergarten and Transition Classes.*

(1.) Describe an ideal classroom for children five years old, and the work you would carry on in it during any one morning. Indicate the main principles which would guide you in drawing up the programme.

(2.) In what main essentials would a time-table for young children differ from that for children in the lower forms? Draw up a time-table for one week for children six years of age.

(3.) State briefly any defects you have yourself noticed in the training of children in the kindergarten. How would you remedy these defects? And what do you consider to be the special qualifications of a good kindergarten teacher?

3. *Class Teaching.*

The examination in class teaching is entirely practical. The student is advised to choose a game, story, and Nature lesson, having some connection with each other, so as to use the forty-five minutes allowed to the best advantage. She is allowed to take them in any order—for example, story, then Nature lesson, then game.

Story.—Great care should be exercised in the choice of a story. It should have a decided literary value, should not be too long, and should be told with taste and feeling. Illustrations should be used with care.

Nature Lesson.—Suitable specimens should be provided for each child. These should be examined, and the teacher should be careful not to impart too much information, but should make use of the children's observations.

Game.—This should be as spontaneous as possible, the teacher making use of the children's suggestions.

4. *Blackboard Drawing.*

(1.) *Memory Drawing.*—Each sketch must be of a size to fairly fill one sheet (16″ × 14″ size of sheet). The drawings must be in outline only in white chalk.

(i.) *Plants.*—Foxglove, or wheat-ears, or maple leaves, or greengages. Wallflower, or tomatoes, or hawthorn leaves, or walnuts. Wild-rose, or pea-pods, or lime leaves, or grapes.

(ii.) *Animals.*—Hedgehog, or lobster, or sparrow, or butterfly. Squirrel, or haddock, or swallow, or dragon-fly. Rabbit, or crab, or gull, or bee.

(iii.) *Object.*—Brush and comb, or barrel. Knife and fork, or lamp. Pair of bellows, or kettle.

(2.) *Model Drawing.*—Draw from the models placed before you a wash-hand jug and basin, and a soap-dish standing on a board. The board is also to be drawn. (The eye level must be indicated in the sketch.)

(3.) *From Nature.*—Sketch from Nature, enlarged, the spray of pansies or geranium with which you are provided. Show, on the corner of the sheet, the actual size of the specimen.

(4.) *Free Illustration.*—Make one illustration which would be useful either in a lesson on the builder and his work, or a talk about a day in the country.

(5.) Make an enlarged drawing of the sketch of a windmill, given below.

5. *Nature Knowledge.*

(1.) *Plant Life.*

A. (i.) What differences are to be noted in winter between beech and horse chestnut trees?

(ii.) How would you recognise (*a*) in winter, and (*b*) in summer, the following trees—chestnut, plane, poplar? At what time of the year does each of these trees flower?

(iii.) Describe briefly, with drawings, a branch of a tree—for example, of a horse chestnut in winter. Explain carefully what may be learnt from such a branch.

B. (i.) You propose to give a lesson on snow immediately after a heavy fall. Explain what points you would try to bring out in your lesson.

(ii.) On a winter's day the mercury in the barometer falls suddenly through a considerable distance. What would you expect to occur? Why?

(iii.) By what simple experiment can you show that air in which a candle has been burning is altered? What conclusions can be drawn from these experiments? What effect on the purity of the air of a room has (*a*) a burning lamp, (*b*) a fire?

(2.) *Animal Life.*

(i.) Compulsory.—Mention four animals that might be kept in a classroom for the purpose of studying their life histories, detail the arrangements you would make for their comfort and well-being, and describe briefly the visible changes to be observed in the life history of any two of them. (The word "animal" is used in its widest sense.)

(ii.) Detail carefully the chief points to be noted in a revision lesson on the mammals.

(iii.) Write short notes on the following subjects—hibernation of animals, migration of birds. Give familiar instances.

(iv.) Give an account of the habits of the bat. In what important respects does it differ from a bird? By what modifications of structure is it adapted for flight?

6. *Educational Handwork.*

(1.) Compulsory.—What are the chief differences between educative and mechanical handwork (*a*) in general method of teaching, (*b*) in material results?

(2.) Compulsory.—Give reasons why handwork should be regarded as a very important portion of the curriculum.

(3.) If you were educating three children between the ages of three and seven, with the conditions of a reasonably good nursery and garden, what materials would you provide for their motor activities? Estimate approximately the cost of these materials.

(4.) How may the principle of correlation be either a help or a hindrance in handwork?

(5.) Suggest toys or materials of any kind that might be used as a means of building up ideas. How did Froebel demonstrate that ideas might be formed in this way?

Words by JANE TAYLOR.

"THE VIOLET."

Music by C. E. PARKINSON.

UNISON SONG FOR JUNIOR CLASSES.

Andante con moto.
mf
rall.
Fine.
mf
1. Down in a green and sha - dy bed, A mo - dest vio - let grew; Its stalk was bent, it
p
dim.
pp
mf
cres.
hung its head, As if to hide from view. 2. And yet it was a love - ly flower, Its
dim.
pp
mf
Largamente
cen . . . do.
f
D.S.
col - ours bright and fair; It might have graced a ro - sy bower, In - stead of hid - ing there.
rall . e . dim.
e marcato.
f

3. Yet there it was content to bloom,
In modest tints arrayed;
And there diffused its sweet perfume
Within the silent shade.

4. Then let me to the valley go,
This pretty flower to see;
That I may also learn to grow
In sweet humility.

SONG—"PETER PAN."

Words by JESSIE M'KAY. *Music by* F. H. SQUIRES, F.R.C.O.

Allegretto.
p
Do you be-lieve in fair - ies? I asked of Pet - er Pan. Where
p Legato.
Ped.
mf
is the fair - y coun - try? Pray, tell me, if you can. Please tell me where they come from, Where
mf
Ped. * Ped.
rit.
are the fair - ies born. Young Pe - ter eyed me sad - ly, To think me so for - lorn.
rit.
Ped. *
Ped. Ped. * Ped. * Ped. *
con espressione.
One day a ti - ny ba - by Slept on his moth - er's knee: He
Ped. * Ped.

rit.
laughed a - loud in dream - land, Be - cause he dreamed of me; . . . And
as the ba - by laugh - ter Broke on the sum - mer air, Each
tempo.
Ped.
rall. a tempo. dolce.
piece be - came a fair - - y, And flew off then and there. . Since
rall.
tempo. dolce.
Ped.
then the first sweet rip - ple, From ev' - ry ba - by's lips, . . Be -
Ped. sempre.
cres. f
comes a dain - ty fair - y, To Nev - er land it trips. . . And
cres.
cres.

A CORRELATED SCHEME BASED UPON ÆSOP'S FABLES.

BY THE HEAD MISTRESS OF ST. WILFRID'S INFANTS' SCHOOL, HULME, MANCHESTER.

"The Old Man and His Ass."

AN old man and his son were driving their ass to market in order to sell him. On their way they met some men, who said, "What a silly pair, to walk all the way and let the donkey go free!" At once the old man bade his son mount the ass, while he walked by the side. A little farther on they met an old woman, who abused the boy for riding while his father walked. To please her, the father and son changed places. They proceeded in this way for some distance, till they encountered some women and children, who cried shame on the old man for riding while his son was hardly able to walk. "Get up behind me," said the father. "We will both ride, and so please both parties." They jogged on in this way for some time, but just as they got near the town a young man accosted them. "Pray, friend, is that ass your own?" "Yes," replied the old man. "One would not think so by the way you load him. Why, you two are better able to carry the poor beast than he you." "Well," said the old man, "it is hard to please every one, but we will try to do as you wish." So saying, they dismounted, tied the ass's legs to a long pole, and carried him between them. Of course every one began to laugh at them; and the ass, struggling to get free, broke the cords that held him, and falling into a river was drowned. The old man went home very sad. In trying to please everybody he had pleased no one, and lost his ass as well.

Object Lessons.—1. The Ass.

Illustrations.—Picture of donkey. Picture of horse. Seaside scene, with donkeys on the sands.

Preparation.—Connect with tale. Emphasise the foolishness of the man and his son, first in overloading the ass, and then trying to carry it.

Presentation.

1. *Description.—The ass is a domestic animal used as a beast of burden.* Teach by reference to the children's personal observation of—

(*a*) The "rag-and-bone man's" cart.

(*b*) The donkey seen on the sands at the seaside.

2. *Structure and Appearance.*—By careful examination of picture of donkey and comparison with that of horse, lead children to note—

(*a*) *Body*, long and strong.

(*b*) *Head*, long, broader and less pointed than that of horse, hangs down.

(*c*) *Ears*, much larger than those of the horse, erect, bent backward.

(*d*) *Neck*, short, thick, with short erect mane.

(*e*) *Hoof*, hard, horny, more oval than that of the horse, hollow in the centre, with rim round the edge.

(*f*) *Legs*, shorter and thicker than those of horse.

(*g*) *Skin*, thick, covered with rough, shaggy hair, mostly gray, with black stripe along back and across the shoulder.

(*h*) *Tail*, covered with short hair, ends in a tuft. (Compare with long flowing tail of the horse.)

3. *Habits.*—When wild, lives in herds; when domesticated, works hard. Intelligent and active if well treated, stupid and dogged if badly treated. Fights by kicking hind legs. Is very

sure-footed and a good climber. (Refer to formation of hoof, and show use of rim round the edge.)

4. *Food.*—Vegetable. Is content with coarse food, such as thistles, heather, etc., hence often called "the poor man's friend." Is very particular about the water it drinks.

Reading.

Sound ass, class, glass, grass, lass, mass, pass.

Ben had an ass. He took such good care of it that it got a first-class prize at the show. In summer Ben took his ass down to the sands. The children liked to ride on Ben's ass. When a little lass got on the ass's back, Ben would not let the ass trot; but when a big lad was riding, he would call out, "Trot, Ned, trot! We will have a race!" and Ned could always pass all the other asses. At twelve o'clock Ben gave his ass some nice fresh grass, and took a glass of milk and a bun himself.

2. The Thistle.

Illustrations.—Plant, if possible. Picture of thistle. Sketch showing seeds escaping.

Preparation.—Connect with tale and with lesson on ass. Dwell on food of ass.

Presentation.

1. *Description.*—Let children examine plant or picture, and note.

Teacher's Illustration.

(*a*) *Strong, thick stem.* Tell children some thistles have no stem.

(*b*) *Thick, rough skin.*

(*c*) *Shape of leaves.*

(*d*) *Prickles* or spines on leaves.

(*e*) *Shape and colour of flowers.* Colour varies from pink to purple. Some varieties have white or yellow flowers.

(*f*) *Seeds.* Make children note well the downy hairs attached to each seed.

2. *Locality.*—Describe how thistle will grow in waste places—rocky places, places where scarcely anything else could grow. Make children notice how light the seeds are, and how the downy hairs keep them floating in the air. Lead children to see how easily these seeds are dispersed by the wind.

3. *Use.*—(*a*) *Fodder.* Refer to lesson on ass.

(*b*) *As a vegetable.* In many places the young roots are boiled and eaten; the leaves are used as a salad.

(*c*) Tell children how each thistle as it dies makes a little more soil, and so helps to prepare waste ground for cultivation.

Reading.

Story of a Thistle.

Have you ever seen a "Scotch cap"? Did you see the little silver thistle in the brim? I will tell you why Scotch men and boys are so fond of the thistle. Long, long ago some men called Danes came in big ships to fight the Scots. They landed at night. The Scotch soldiers were all fast asleep, and the Danes crept up to kill them; but just as they got near, one of them trod on a thistle and hurt his foot. He cried out in pain, and woke one of the Scotsmen. When he saw the Danes, he blew a whistle, and all the Scotch soldiers started up. They fought the Danes and beat them, and so ever since the Scotch all love the thistle.

3. Rain. First Lesson.

Presentation.

Experiment.	*Observation.*	*Inference.*
1. Boil some water in a kettle.	1. Steam comes from spout of kettle.	1. Heat turns water into steam.
2. Put small quantity of water in iron spoon, and hold spoon over bunsen burner.	2. Spoon is soon quite dry.	"
3. Hold wet rag near burner or before fire.	3. Rag soon dries.	"
4. Hold slate or plate near spout of boiling kettle.	4. Slate or plate soon covered with tiny drops of water.	4. Cold turns steam (vapour) into water.

Rain. Second Lesson.

Preparation.—Revise last lesson, so that the two facts taught are clearly before the children's minds.

Presentation.—By questioning lead the children to suggest—

(*a*) *How quickly* the playground dries up when the sun comes out after a shower.

(*b*) *That it is the heat* of the sun which dries the playground.

(*c*) *That the sun turns* the wet into vapour (steam). Make the children notice that the steam is invisible coming out of the spout.

(*d*) *That the vapour* is in the air.

(*e*) *That as this vapour cools* it becomes visible. Refer again to appearance of steam from kettle. Refer also to steam floating over railway train. Show picture of clouds, and lead children to suggest simple explanation of their formation.

(*f*) *That rain comes from the clouds.* (Point of saturation is, of course, too difficult for children of this age.)

Reading.

Sound *ain*, brain, gain, lain, main, stain, sprain, pain, rain, vain.

Poor Tom is in great pain. He gave his foot a bad sprain, and he has lain three weeks in bed. His mother said he could go out to the garden this morning; but just as he was ready, down came the rain. It rained and rained, as if it would never stop again; so it was vain for poor Tom to hope to get out. He got his slate, and began to draw. There was an ink-bottle on the table. Baby May got on a chair to see Tom's slate, and knocked the ink-bottle down, and the ink made a big stain on the carpet.

4. Carrots and Turnips.

Preparation.—Short conversation on the use of carrots and turnips.

Presentation.—Lesson may take the form of a comparison lesson, and children should be led to suggest the following points: difference in size, shape, colour, thickness of skin, shape of leaves.

Our Query Column.

SOLUTIONS BY A. CLEMENT JONES, M.A., PH.D., SENIOR MATHEMATICAL MASTER, BRADFORD GRAMMAR SCHOOL.

RULES.

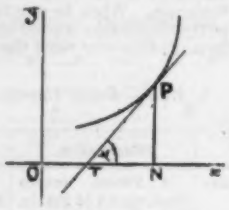
1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

D'Arcy.—In the tractory

$$x = \sqrt{c^2 - y^2} + \frac{c}{2} \log \frac{c - \sqrt{c^2 - y^2}}{c + \sqrt{c^2 - y^2}}$$

prove that the portion of the tangent intercepted between the point of contact and the axis of x is of constant length.



In the figure PT is the length asked for in the question.

Hence $PT = PN \operatorname{cosec} \psi = y \operatorname{cosec} \psi$.

In the equation to the tractory put

$$y = c \sin \theta.$$

Hence
$$x = c \cos \theta + \frac{c}{2} \log \frac{1 - \cos \theta}{1 + \cos \theta}$$
$$= c \cos \theta + c \log \tan \frac{\theta}{2}.$$

Thus
$$\frac{dx}{d\theta} = -c \sin \theta + \tfrac{1}{2}c \cdot \frac{\sec^2 \frac{\theta}{2}}{\tan \frac{\theta}{2}}$$
$$= -c \sin \theta + \frac{c}{\sin \theta} = \frac{c \cos^2 \theta}{\sin \theta},$$

and
$$\frac{dy}{d\theta} = c \cos \theta.$$

Hence
$$\tan \psi = \frac{dy}{dx} = \frac{dy}{d\theta} \div \frac{dx}{d\theta} = \tan \theta.$$

$\therefore$ $\psi = \theta$.

$\therefore$ $y = c \sin \theta = c \sin \psi$.

$\therefore$ $PT = y \operatorname{cosec} \psi = c \sin \psi \operatorname{cosec} \psi = c$.

Mavesyn.—Show that if c be < 1,

$$\text{(i)} \int_0^{\frac{\pi}{2}} \sin^{-1}(c \cos x)\,dx = \frac{c}{1^2} + \frac{c^3}{3^2} + \frac{c^5}{5^2} + \frac{c^7}{7^2} + \dots$$

$$\text{(ii)} \frac{1}{\pi} \int_0^{\frac{\pi}{2}} [\sin^{-1}(c \cos x)]^2\,dx = \frac{c^2}{2^2} + \frac{c^4}{4^2} + \frac{c^6}{6^2} + \frac{c^8}{8^2} + \dots$$

The first part can be done quite easily by differentiating the integral with respect to c, integrating the result with respect to x, and integrating the final result with respect to c. This process appears, however, to be difficult in the second case, so I have given a similar solution to both. We know that

$$\int_0^{\frac{\pi}{2}} \cos^{2n} \theta = \frac{2n-1}{2n} \cdot \frac{2n-3}{2n-2} \cdot \frac{2n-5}{2n-4} \cdots \frac{3}{4} \cdot \frac{1}{2} \cdot \frac{\pi}{2},$$

and
$$\int_0^{\frac{\pi}{2}} \cos^{2n+1} \theta = \frac{2n}{2n+1} \cdot \frac{2n-2}{2n-1} \cdots \frac{2}{3},$$

so that if we can expand $\sin^{-1}(c \cos x)$ and $[\sin^{-1}(c \cos x)]^2$ in powers of $\cos x$ the result must follow.

(i) To expand $\sin^{-1} z$ in powers of z.

Let $y = \sin^{-1} z = a_0 + \frac{a_1}{1} z + \frac{a_2}{\underline{2}} z^2 + \frac{a_3}{\underline{3}} z^3 + \dots$

Then
$$\frac{dy}{dz} = \frac{1}{\sqrt{1 - z^2}} = a_1 + \frac{a_2}{\underline{1}} z + \frac{a_3}{\underline{2}} \cdot z^2 + \dots$$

that is,
$$1 + \frac{1}{2} z^2 + \frac{\frac{1}{2} \cdot \frac{3}{2}}{1 \cdot 2} z^4 + \frac{\frac{1}{2} \cdot \frac{3}{2} \cdot \frac{5}{2}}{1 \cdot 2 \cdot 3} \cdot z^6 + \dots$$
$$= a_1 + \frac{a_2 z}{\underline{1}} + \frac{a_3 z^2}{\underline{2}} + \dots$$

Hence $a_0, a_2, a_4, a_6 \dots$ are all zero, and

$$\frac{a_{2n+1}}{\underline{2n}} = \text{coefficient of } z^{2n}$$
$$= \frac{\frac{1}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdots \frac{2n-1}{2}}{\underline{n}}$$

Hence
$$\sin^{-1} z = \sum_0^{\infty} \frac{1 \cdot 3 \cdot 5 \dots 2n-1}{2^n \cdot \underline{n}} \cdot \frac{z^{2n+1}}{2n+1},$$

and
$$\sin^{-1}(c \cos x) = \sum_0^{\infty} \frac{1 \cdot 3 \cdot 5 \dots 2n-1}{2^n \cdot \underline{n}} \cdot \frac{c^{2n+1} \cos^{2n+1} x}{2n+1}.$$

Now the integral of the general term between the limits 0 and $\frac{\pi}{2}$ is

$$\frac{1 \cdot 3 \cdot 5 \dots 2n-1}{2^n \cdot \underline{n} \cdot 2n+1} \cdot c^{2n+1} \cdot \frac{2n \cdot 2n-2 \cdot 2n-4 \dots 2}{2n+1 \cdot 2n-1 \cdot 2n-3 \dots 3}$$
$$= \frac{c^{2n+1}}{(2n+1)^2}.$$

Thus
$$\int_0^{\frac{\pi}{2}} \sin^{-1}(c \cos x) = \sum_0^{\infty} \frac{c^{2n+1}}{(2n+1)^2} = \frac{c}{1^2} + \frac{c^3}{3^2} + \frac{c^5}{5^2} + \dots$$

(ii) To expand $(\sin^{-1} z)^2$ in powers of z.

Let $y = (\sin^{-1} z)^2 = a_0 + \frac{a_1}{1} z + \frac{a_2}{\underline{2}} z^2 + \frac{a^3}{\underline{3}} z^3 + \dots$

then a_n is the value of $\frac{d^n y}{dz^n}$ when $z = 0$.

Now
$$\frac{dy}{dz} = \frac{2 \sin^{-1} z}{\sqrt{1 - z^2}}.$$

$\therefore$ $\sqrt{1 - z^2} \cdot \frac{dy}{dz} = 2 \sin^{-1} z$.

$\therefore$ $\sqrt{(1 - z^2)}\, \frac{d^2 y}{dz^2} - \frac{z}{\sqrt{1 - z^2}} \frac{dy}{dz} = \frac{2}{\sqrt{1 - z^2}}$.

$\therefore$ $(1 - z^2) \frac{d^2 y}{dz^2} - z \frac{dy}{dz} = 2$.

Apply Leibnitz to each term, then

$$(1 - z^2) \frac{d^{n+2} y}{dz^{n+2}} - 2nz \frac{d^{n+1} y}{dz^{n+1}} - n(n-1) \cdot \frac{d^n y}{dz^n}$$

$$-z\frac{d^{n+1}y}{dz^{n+1}} - n\cdot\frac{d^ny}{dz^n} = 0,$$

or $(1-z^2)\dfrac{d^{n+2}y}{dz^{n+2}} - (2n+1)z\cdot\dfrac{d^{n+1}y}{dz^{n+1}} - n^2\dfrac{d^ny}{dz^n} = 0.$

Put $z=0$, then

$$a_{n+2} = n^2a_n. \quad \ldots\ldots\ldots \text{(i)}$$

If we take $\sin^{-1}z = 0$ when $z=0$, then $\dfrac{dy}{dz}$ is zero when $z=0$. Hence $a_1=0$. Consequently a_3, a_5, a_7 ... equal zero, using relation (i). Evidently also $a_0=0$.

Again, when $z=0$, $\dfrac{d^2y}{dz^2}=2$. Hence $a_2=2$.

Thus $a_{2n} = (2n-2)^2\cdot a_{2n-2}$
$= (2n-2)^2\cdot(2n-4)^2\cdot a_{2n-4}$
. . . . . .
$= (2n-2)^2(2n-4)^2(2n-6)^2\ldots 2^2\cdot a_2.$

Thus the general term in the expansion is

$$\frac{(2n-2)^2(2n-4)^2(2n-6)\ldots 2^2\cdot 2}{\lfloor 2n}z^{2n},$$

and the general term in the expansion of $[\sin^{-1}(c\cos x)]^2$ is

$$\frac{(2n-2)^2(2n-4)^2(2n-6)^2\ldots 2^2}{\lfloor 2n}\cdot 2c^{2n}\cos^{2n}x.$$

Integrating this between the limits 0 and $\frac{\pi}{2}$, we get

$$\frac{(2n-2)^2\cdot(2n-4)^2(2n-6)^2\ldots 2^2}{\lfloor 2n}\cdot 2c^{2n}$$
$$\cdot\frac{2n-1\,.\,2n-3\,.\,2n-5\ldots 3\,.\,1}{2n\,.\,2n-2\,.\,2n-4\ldots 4\,.\,2}\cdot\frac{\pi}{2} = \frac{\pi\cdot c^{2n}}{(2n)^2}.$$

Thus $$\frac{1}{\pi}\int_0^{\frac{\pi}{2}}[\sin^{-1}(c\cos x)]^2\,dx = \sum_1^{\infty}\frac{c^{2n}}{(2n)^2}$$
$$= \frac{c^2}{2^2} + \frac{c^4}{4^2} + \frac{c^6}{6^2} + \frac{c^8}{8^2} + \ldots$$

François.—Sum the following series:—

(*a*) $n\sin\theta + (n-1)\sin 2\theta + (n-2)\sin 3\theta + \ldots + \sin n\theta.$

(*b*) $1 + n\cos\theta + \dfrac{n(n-1)}{1\,.\,2}\cos 2\theta + \ldots + \cos n\theta.$

(Board of Education, Hons., 1909.)

(*a*) Let $S = n\sin\theta + (n-1)\sin 2\theta + (n-2)\sin 3\theta + \ldots + \sin n\theta$, and $C = n\cos\theta + (n-1)\cos 2\theta + (n-2)\cos 3\theta + \ldots + \cos n\theta$.

Hence $C + iS = ne^{i\theta} + (n-1)e^{i2\theta} + (n-2)e^{i3\theta} + \ldots + e^{in\theta}$.

Now $(n-r) - 2(n-r-1) + (n-r-2) = 0$.

Thus, calling $C + iS \equiv x$,

$$\begin{aligned} x = {} & ne^{i\theta} + (n-1)e^{i2\theta} + (n-2)e^{i3\theta}\ldots \\ & + 3e^{i(n-2)\theta} + 2e^{i(n-1)\theta} + e^{in\theta}. \\ -2e^{i\theta}x = {} & -2ne^{i2\theta} - 2(n-1)e^{i3\theta} - \ldots \\ & - 8e^{i(n-2)\theta} - 6e^{i(n-1)\theta} - 4e^{in\theta} - 2e^{i(n+1)\theta}. \\ e^{i2\theta}x = {} & ne^{i3\theta} + \ldots \\ & + 5e^{i(n-2)\theta} + 4e^{i(n-1)\theta} + 3e^{in\theta} + 2e^{i(n+1)\theta} + e^{i(n+2)\theta}. \end{aligned}$$

Adding $x(1 - 2e^{i\theta} + e^{i2\theta}) = ne^{i\theta} - (n+1)e^{i2\theta} + e^{i(n+2)\theta}.$

Now $$(1 - 2e^{i\theta} + e^{i2\theta}) = (e^{i\theta}-1)^2 = e^{i\theta}\left(e^{\frac{i\theta}{2}} - e^{-\frac{i\theta}{2}}\right)^2$$
$$= e^{i\theta}\times -4\sin^2\frac{\theta}{2}. \quad \because \sin\frac{\theta}{2} = \frac{e^{\frac{i\theta}{2}} - e^{-\frac{i\theta}{2}}}{2i}.$$

Hence $$4\sin^2\frac{\theta}{2}x = -n + (n+1)e^{i\theta} - e^{i(n+1)\theta}$$
$$= \{-n + (n+1)\cos\theta - \cos(n+1)\theta\} + i\{(n+1)\sin\theta - \sin(n+1)\theta\}.$$

Thus equating real and imaginary parts,

$$S = (n+1)\frac{\sin\theta}{4\sin^2\frac{\theta}{2}} - \frac{\sin(n+1)\theta}{4\sin^2\frac{\theta}{2}}$$
$$= \frac{n+1}{2}\cdot\cot\frac{\theta}{2} - \frac{\sin(n+1)\theta}{4\sin^2\frac{\theta}{2}}.$$

(*b*) Let $C = 1 + n\cos\theta + \dfrac{n(n-1)}{1\,.\,2}\cos 2\theta + \ldots + \cos n\theta.$

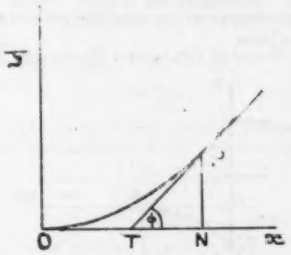
$$S = n\sin\theta + \frac{n(n-1)}{1\,.\,2}\sin 2\theta + \ldots + \sin n\theta.$$

Hence $C + iS = 1 + ne^{i\theta} + \dfrac{n(n-1)}{1\,.\,2}e^{i2\theta} + \ldots + e^{in\theta}$
$= (1 + e^{i\theta})^n$
$= e^{\frac{in\theta}{2}}\left(e^{\frac{i\theta}{2}} + e^{-\frac{i\theta}{2}}\right)^n = 2^n\cos^n\frac{\theta}{2}\cdot e^{\frac{in\theta}{2}}$
$= 2^n\cos^n\frac{\theta}{2}\left\{\cos n\frac{\theta}{2} + i\sin n\frac{\theta}{2}\right\}.$

$\therefore C = 2^n\cos^n\frac{\theta}{2}\cdot\cos\frac{n\theta}{2}.$

Janet.—Show that the area included between the curve $s = a\tan\psi$, its tangent at $\psi=0$, and its tangent at $\psi=\phi$ is

$$\tfrac{1}{2}a^2\tan\phi + a^2\tan\frac{\phi}{2} - a^2\log(\sec\phi + \tan\phi).$$



The area required is that between the curve at the lines PT and TO.

Area PTO = area PNO − area PNT.

And if P is the point (x', y'), this area

$$= \int_0^{x_1} y\,dx - \tfrac{1}{2}y'^2\cdot\cot\phi$$
$$= \int_0^{\phi} y\frac{dx}{d\psi}\cdot d\psi - \tfrac{1}{2}y'^2\cdot\cot\phi.$$

Now $s = a\tan\psi$.

$$\therefore \sec\psi = \frac{ds}{dx} = a\sec^2\psi\cdot\frac{d\psi}{dx}.$$
$$\therefore \frac{dx}{d\psi} = a\sec\psi.$$

And $$\operatorname{cosec}\psi = \frac{ds}{dy} = a\sec^2\psi\cdot\frac{d\psi}{dy}.$$
$$\therefore \frac{dy}{d\psi} = a\sec\psi\tan\psi.$$
$$\therefore y = a\sec\psi + \text{constant}.$$

But $y=0$ and $\psi=0$ simultaneously.

$$\therefore y = a\sec\psi - a.$$

Hence area

$$= \int_0^{\phi}(a\sec\psi - a)\cdot a\sec\psi\cdot d\psi - \tfrac{1}{2}(a\sec\phi - a)^2\cdot\cot\phi$$
$$= \int_0^{\phi}a^2\sec^2\psi\,d\psi - \int_0^{\phi}\frac{a^2\,d\psi}{\cos\psi} - \frac{a^2}{2}\frac{(1-\cos\phi)^2}{\cos\phi\sin\phi}$$
$$= a^2\tan\phi - a^2\log(\sec\phi + \tan\phi) - \frac{a^2}{2}\frac{(1 - 2\cos\phi + \cos^2\phi)}{\cos\phi\sin\phi}$$
$$= a^2\tan\phi - a^2\log(\sec\phi + \tan\phi) - \frac{a^2}{2}\frac{(\sin^2\phi - 2\cos\phi + 2\cos^2\phi)}{\cos\phi\sin\phi}$$
$$= \tfrac{1}{2}a^2\tan\phi - a^2\log(\sec\phi + \tan\phi) + a^2\frac{(1-\cos\phi)}{\sin\phi}.$$

Comus.—Prove that for the curve

$$s = m(\sec^3\psi - 1),$$
$$\rho = 3m\tan\psi\sec\psi,$$

and hence that

$$3m\frac{dy}{dx}\frac{d^2y}{dx^2} = 1.$$

Differentiating the given equation,

$$\rho = \frac{ds}{d\psi} = 3m \sec^2\psi \,.\, \sec\psi \tan\psi = 3m \sec^3\psi \tan\psi.$$

Also $$\frac{dy}{dx} = \tan\psi.$$

$$\therefore \frac{d^2y}{dx^2} = \sec^3\psi \,.\, \frac{d\psi}{dx} = \sec^2\psi \,.\, \frac{d\psi}{ds} \,.\, \frac{ds}{dx}$$

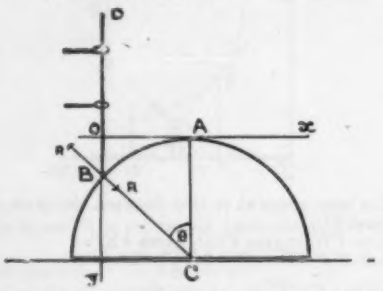
$$= \sec^2\psi \,.\, \frac{1}{\rho} \,.\, \sec\psi.$$

$$\therefore \frac{\rho}{\sec^3\psi} \frac{d^2y}{dx^2} = 1. \quad \therefore 3m \tan\psi \frac{d^2y}{dx^2} = 1.$$

$$\therefore 3m \frac{dy}{dx} \,.\, \frac{d^2y}{dx^2} = 1.$$

Mechanics.—A heavy rod is constrained to slide in a vertical line, with its lower end on the curved surface of an equally heavy smooth hemisphere, the hemisphere sliding on a smooth horizontal plane. Determine the motion. Solve the equations of motion for the case in which initially the rod is very nearly in its highest position.

(Board of Education, Mechanics, St. 3, 1908.)



Let the end of the rod be at the point B of the sphere, and $\angle ACB = \theta$.

Take the horizontal and vertical lines OA . OB as axes of x and y, and let $OA = x$, $OB = y$.

If R is the reaction between the rod and the sphere, the equations of motion are

$$R \sin\theta = M \frac{d^2x}{dt^2}. \quad . \quad . \quad . \quad . \quad \text{(i)} \quad [\text{For motion of sphere.}]$$

$$Mg - R\cos\theta = M \frac{d^2y}{dt^2}. \quad . \quad . \quad . \quad . \quad \text{(ii)} \quad [\text{For motion of rod.}]$$

where M = the mass of the rod or hemisphere.

We have also the geometrical relations

$$x = a \sin\theta, \; y = a - a\cos\theta,$$

where a is the radius of the sphere.

Differentiating these,

$$\frac{d^2x}{dt^2} = -a\sin\theta \left(\frac{d\theta}{dt}\right)^2 + a\cos\theta \,.\, \frac{d^2\theta}{dt^2},$$

$$\frac{d^2y}{dt^2} = a\cos\theta \left(\frac{d\theta}{dt}\right)^2 + a\sin\theta \frac{d^2\theta}{dt^2}.$$

Hence $$a \frac{d^2\theta}{dt^2} = g\sin\theta, \; . \; . \; . \; . \; . \; . \; . \; . \quad \text{(iii)}$$

which equation, when integrated, gives the value of θ, and therefore the position of the bodies in terms of the time t from the initial position. The velocities and accelerations can be found by substituting this value of θ in

$$\frac{dx}{dt} = a\cos\theta \,.\, \frac{d\theta}{dt} \text{ and } \frac{dy}{dt} = a\sin\theta \,.\, \frac{d\theta}{dt},$$

and the equations for $\frac{d^2x}{dt^2}$ and $\frac{d^2y}{dt^2}$ given above.

The equation can also be got from the principle of *Vis Viva*. Thus

$$\tfrac{1}{2}M\left(\frac{dx}{dt}\right)^2 + \tfrac{1}{2}M\left(\frac{dy}{dt}\right)^2 = Mg(y - k),$$

where k is the initial distance of B below the x-axis.

Since B remains in contact with the sphere, the resolved parts of the velocities of the rod and sphere along the normal are equal—that is,

$$\frac{dx}{dt} \,.\, \sin\theta = \frac{dy}{dt} \,.\, \cos\theta.$$

Hence $$\tfrac{1}{2}M\left(\frac{dy}{dt}\right)^2 \operatorname{cosec}^2\theta = Mg(y - k),$$

or $$\left(\frac{d\theta}{dt}\right)^2 = \frac{2g}{a^2}(a - k - a\cos\theta).$$

This equation gives the velocity in any position, and is the first integral of equation (iii), obtained by multiplying each side by $\frac{d\theta}{dt}$.

Now if the end of the rod is nearly at A initially, this means that k is very small. Thus

$$\left(\frac{d\theta}{dt}\right)^2 \text{ is nearly equal to } \frac{2g}{a}(1 - \cos\theta);$$

that is, $$\frac{4g}{a}\sin^2\frac{\theta}{2}.$$

Hence $$\frac{d\theta}{dt} = 2\sqrt{\frac{g}{a}} \,.\, \sin\frac{\theta}{2}.$$

$$\therefore t\sqrt{\frac{g}{a}} = \tfrac{1}{2}\int \frac{d\theta}{\sin\frac{\theta}{2}} = \log\left(\tan\frac{\theta}{2}\right) + \text{const.}$$

When $t = 0$, θ is small and equal to α, say.

$$\therefore t\sqrt{\frac{g}{a}} = \log\frac{\tan\frac{\theta}{2}}{\tan\frac{\alpha}{2}}.$$

$$\therefore \tan\frac{\theta}{2} = \tan\frac{\alpha}{2} e^{t\sqrt{\frac{g}{a}}},$$

which gives the value of θ, and hence the position of the rod at any time after the commencement of motion. The time of motion from any position $\theta = \beta$ to another position $\theta = \gamma$ is

$$\sqrt{\frac{a}{g}} \log\left(\tan\frac{\beta}{2}\cot\frac{\gamma}{2}\right).$$

Tomo.—Will you kindly repeat your query?

Ridware.—The curve $r = a(1 - e\cos\theta)$, where e is very small, revolves about a tangent parallel to the initial line. Prove that the volume of the solid thus generated is approximately $2\pi^2a^3(1 + e^2)$.

Since e is very small, the curve is nearly the same as the circle $r = a$, the radii in the first quadrant being rather less than a, and in the second quadrant greater than a. Further, since $\cos\theta = \cos(-\theta)$ the curve is symmetrical about the initial line, hence the centre of gravity of the curve lies on the initial line.

Now at the point where the tangent is parallel to the initial line, we have

$$\phi + \theta = \pi.$$

$$\therefore \quad \tan\phi = -\tan\theta.$$

But $$r = a(1 - e\cos\theta).$$

$$\therefore \quad 1 = ae\sin\theta \,.\, \frac{d\theta}{dr}.$$

$$\therefore \quad \tan\phi = r\frac{d\theta}{dr} = \frac{1 - e\cos\theta}{e\sin\theta} = \frac{-\sin\theta}{\cos\theta}.$$

$$\therefore \quad \cos\theta - e\cos^2\theta + e\sin^2\theta = 0.$$

$$\therefore \quad 2e\cos^2\theta - \cos\theta - e = 0.$$

$$\therefore \quad \cos\theta = \frac{1 \pm \sqrt{1 + 8e^2}}{4e},$$

which approximately $= \frac{1 \pm (1 + 4e^2)}{4e}$.

$$\therefore \quad \cos\theta = \frac{1 + 2e^2}{2e} \text{ or } -e.$$

Since e is very small, the first value, which is > 1, is inadmissible,

$$\therefore \quad \cos\theta = -e.$$

Hence at the point of contact

$$r\sin\theta = a(1 - e\cos\theta) \,.\, \sin\theta$$

$$= a(1 + e^2)\sqrt{1 - e^2}$$

$$= a(1 + e^2)(1 - \tfrac{1}{2}e^2),$$

omitting e^4 and higher powers

$$= a\left(1 + \frac{e^2}{2}\right);$$

and since the centre of gravity is on the initial line, this is the distance of the centre of gravity from the line of revolution.

The area of the curve

$$= 2 \times \tfrac{1}{2}\int_0^{\pi} r^2 d\theta$$

$$= a^2\int_0^{\pi} (1 - 2e\cos\theta + e^2\cos^2\theta)d\theta$$

$$= a^2\int_0^{\pi} \left(1 + \frac{e^2}{2} - 2e\cos\theta + \frac{e^2\cos 2\theta}{2}\right)d\theta$$

$$= a^2\left[\left(1 + \frac{e^2}{2}\right)\theta - 2e\sin\theta + \frac{e^2}{4}\sin 2\theta\right]_0^{\pi}$$

$$= \pi a^2\left(1 + \frac{e^2}{2}\right).$$

Hence by Pappus' Theorem the volume formed by the complete revolution of the curve

$$= 2\pi a\left(1 + \frac{e^2}{2}\right) \times \pi a^2\left(1 + \frac{e^2}{2}\right)$$

$$= 2\pi^2 a^3\left(1 + \frac{e^2}{2}\right)^2$$

$$= 2\pi^2 a^3(1 + e^2) \text{ approximately.}$$

François.—Prove the rule for the multiplication of determinants of the third order.

Show that the square of the determinant

$$\begin{vmatrix} 0 & \cos x & -\sin x \\ \sin x & 0 & \cos x \\ -\cos x & \sin x & 0 \end{vmatrix}$$

can be written in the form

$$\begin{vmatrix} 1 & \lambda & -\lambda \\ \lambda & 1 & \lambda \\ -\lambda & \lambda & 1 \end{vmatrix}$$

and determine the value of λ.

(B.Sc., London, 1909.)

The determinant

$$\begin{vmatrix} a_1 + A_1 & b_1 & c_1 \\ a_2 + A_2 & b_2 & c_2 \\ a_3 + A_3 & b_3 & c_3 \end{vmatrix}$$

is equal to the sum of the determinants

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} + \begin{vmatrix} A_1 & b_1 & c_1 \\ A_2 & b_2 & c_2 \\ A_3 & b_3 & c_3 \end{vmatrix}$$

Now consider the determinant

$$\begin{vmatrix} a_1A_1 + b_1B_1 + c_1C_1 & a_1A_2 + b_1B_2 + c_1C_2 & a_1A_3 + b_1B_3 + c_1C_3 \\ a_2A_1 + b_2B_1 + c_2C_1 & a_2A_2 + b_2B_2 + c_2C_2 & a_2A_3 + b_2B_3 + c_2C_3 \\ a_3A_1 + b_3B_1 + c_3C_1 & a_3A_2 + b_3B_2 + c_3C_2 & a_3A_3 + b_3B_3 + c_3C_3 \end{vmatrix}$$

(1) (2) (3) (4) (5) (6) (7) (8) (9)

This is equal to the sum of 27 determinants, obtained by taking one from each of the sets of columns 1, 2, 3; 4, 5, 6; 7, 8, 9. In every case each column contains a factor, A_1, B_1, or C_1, which can be put outside the corresponding determinant.

After this is done the inside of the determinant contains only small letters: two or more columns will be the same, and consequently the determinant zero, except for those whose columns are 1, 5, 9; 1, 6, 8; 2, 6, 7; 2, 4, 9; 3, 4, 8; 3, 5, 7.

Each of these determinants is the same as

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

multiplied by some factor with the correct sign. Remembering that each interchange of adjacent columns changes the sign, we see that the signs of the above six determinants when they are changed to this form are +, −, +, −, +, −. The sum of these determinants is then

$$(A_1B_2C_3 - A_1C_2B_3 + B_1C_2A_3 - B_1A_2C_3 + C_1A_2B_3 - C_1B_2A_3) \times \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

$$= \begin{vmatrix} A_1 & B_1 & C_1 \\ A_2 & B_2 & C_2 \\ A_3 & B_3 & C_3 \end{vmatrix} \times \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

This argument is quite general, and applies to the multiplication of any two determinants of the same order. To get the first column in the answer impress the first row of one determinant on each row of the other; to get the second column impress the second row of the one on each row of the other, and so on. Now

$$\begin{vmatrix} 0 & \cos x & -\sin x \\ \sin x & 0 & \cos x \\ -\cos x & \sin x & 0 \end{vmatrix} \times \begin{vmatrix} 0 & \cos x & -\sin x \\ \sin x & 0 & \cos x \\ -\cos x & \sin x & 0 \end{vmatrix}$$

$$= \begin{vmatrix} \cos^2 x + \sin^2 x & -\cos x\sin x & \cos x\sin x \\ -\cos x\sin x & \cos^2 x + \sin^2 x & -\cos x\sin x \\ \cos x\sin x & -\cos x\sin x & \cos^2 x + \sin^2 x \end{vmatrix}$$

$$= \begin{vmatrix} 1 & \lambda & -\lambda \\ \lambda & 1 & \lambda \\ -\lambda & \lambda & 1 \end{vmatrix}$$

where $\lambda = -\frac{1}{2}\sin 2x$.

O. P. Q.—Prove that the area in the positive quadrant of the curve

$$(a^2x^2 + b^2y^2)^{\frac{1}{2}} = mx^3 + ny^3$$

is $\dfrac{1}{3ab}\left(\dfrac{m}{a^3} + \dfrac{n}{b^3}\right)$.

The area of the curve in the positive quadrant is found by $\int y dx$ taken round the part of the curve in this quadrant.

But $$\int y dx = \frac{1}{ab}\int (by)d(ax).$$

Put $$\xi = ax,\ \eta = by$$

Hence $$\int y dx = \frac{1}{ab}\int \eta d\xi.$$

This means that we decrease the ordinate and abscissa of each point in the ratios $b:1$ and $a:1$, and thus obtain a new curve whose area is $\dfrac{1}{ab}$ of the old. The part in the positive quadrant of the new curve clearly corresponds to the part of the old in the same quadrant.

The equation of the new curve is

$$(\xi^2 + \eta^2)^{\frac{1}{2}} = \frac{m}{a^3}\cdot\xi^3 + \frac{n}{b^3}\cdot\eta^3,$$

or in polar co-ordinates

$$r^2 = \frac{m}{a^3}\cos^3\theta + \frac{n}{b^3}\sin^3\theta.$$

$$= \tfrac{1}{4}\left\{\frac{m}{a^3}(\cos 3\theta + 3\cos\theta) + \frac{n}{b^3}(3\sin\theta - \sin 3\theta)\right\}.$$

The area in the positive quadrant

$$= \tfrac{1}{2}\int_0^{\frac{\pi}{2}} r^2 d\theta = \tfrac{1}{8}\int_0^{\frac{\pi}{2}} \left\{\frac{m}{a^3}(\cos 3\theta + 3\cos\theta) + \frac{n}{b^3}(3\sin\theta - \sin 3\theta)\right\} d\theta$$

$$= \tfrac{1}{8}\left[\frac{m}{a^3}\left(\frac{\sin 3\theta}{3} + 3\sin\theta\right) + \frac{n}{b^3}\left(-3\cos\theta + \frac{\cos 3\theta}{3}\right)\right]_0^{\frac{\pi}{2}}$$

$$= \tfrac{1}{8}\left\{\frac{m}{a^3}(-\tfrac{1}{3} + 3) + \frac{n}{b^3}(3 - \tfrac{1}{3})\right\}$$

$$= \tfrac{1}{3}\left\{\frac{m}{a^3} + \frac{n}{b^3}\right\}.$$

The area of the original curve is then

$$\frac{1}{3ab}\left\{\frac{m}{a^3} + \frac{n}{b^3}\right\}.$$

THE TEACHING OF TEMPERANCE.

It is easier to inculcate than to teach temperance, but seeing that the Code prescribes a syllabus in the subject, the teacher will find guidance and help in a new publication just issued by the Union Publishing House, and entitled *The Teacher's Guide to the Government Temperance Syllabus.* The book is from the pen of the well-known senior inspector to the Leicester Education Committee, and the moral lessons which it inculcates are rightly based upon physiology and hygiene. From the same publishing house comes *A Collection of Temperance Poems for Old and Young*, which will be found useful for various scholastic and entertainment purposes.

NATURE STUDY EXHIBITIONS.

BY R. L. TREBLE, B.SC., SCIENCE LECTURER IN CULHAM TRAINING COLLEGE.

THE study of Nature has come so much to the fore recently in the elementary schools of the country that it is essential that students during their training in college should devote a considerable amount of time to Nature work. Many of the students who come to our training colleges are absolutely ignorant of the simplest matters which occur round them day after day, and it is with the object of making students observe, think, and reason that Nature Study has been so largely introduced. The field of work is great and always present; no special apparatus is required, and only enthusiasm is needed to make the work a success. Frequently the dull student does better work in Nature Study than his more brilliant companion, and anything which will give him a chance in competition should be welcomed; for his success in one direction quickens his efforts in others, and the result is that he becomes a better man both physically and intellectually, although he may never be brilliant.

Nature Study work is very varied in character; each student is able to map out for himself a course of work which is suited to him. This suggested course of work should be criticised by the master, and then the student should be left to his own resources as far as possible. The work is almost entirely individual, and so interest can be largely increased and sustained by the introduction of competitive work. This can be done best by holding an annual Nature Study Exhibition, in which all the students compete. The expense entailed is slight, as any large room will be suitable, and the students will always be found willing and anxious to help in arranging the exhibits. The scheme of the seventh annual exhibition recently held at Culham College, which was one of the pioneers in connection with Nature Study in training colleges, is given, together with a few remarks on the various sections.

Section 1.—A collection of specimens to illustrate (*a*) plants which grow in hedgerows, (*b*) plants which grow in moist places, (*c*) water plants, (*d*) climbing plants, (*e*) parasitic plants, (*f*) poisonous plants, and (*g*) plants which propagate themselves by means of underground stems.

This section is very useful to a beginner, as there is no doubt that the making of a collection proves of great interest to him, and stimulates his powers of observation. He is always on the lookout for new specimens, and at the same time cannot fail to observe things which are not directly connected with plant life. The best and most convenient method of preserving the specimens is rather doubtful. Perhaps the most general method consists of pressing the plant, but in this way much of the beauty is lost. The difficulty is that in the pressing of the leaves the stem is often completely spoilt. It is very seldom possible to press the whole plant satisfactorily. An improvement on this method is to embed the plants in dry sand, and, if possible, to hasten the drying by keeping the sand in a very warm and dry place. About eighteen days will be found sufficient to dry most plants. The advantage of this method is that the original shape of the plant is kept. Perhaps the best and simplest method is to immerse the plant in a five per cent. solution of formalin, but the drawback is that a large number of specimen bottles is necessary. For exhibition purposes the plants should be named carefully and classified.

Section 2.—A collection to illustrate some of the different forms of (*a*) leaves, (*b*) roots, (*c*) stems, (*d*) buds, and (*e*) seed-vessels.

This section involves a good deal of work to get a satisfactory collection, but the work is perfectly straightforward. Impressions of leaves may be taken by means of printer's ink, and photographs of skeleton leaves may be made to show the various methods of veining.

Section 3.—A collection of specimens to illustrate methods of seed dispersal.

A student who takes up this section will find his work spread over a considerable range of time. His attention will be devoted not only to plants, but also to trees; and here much valuable work may be done. It is astonishing to find how many people are ignorant of the beauties of trees at the different seasons of the year; and if work done in this section were only to attract the attention of students to these beauties, the value of the section would be extremely great. But the various devices which Nature provides for seed dispersal will also be found most interesting. A collection of specimens should be made (preserved in formalin or turpentine), and drawings should accompany the specimens. A most instructive exercise would be to trace the life-history of the seed as it is developed on the tree or plant. This could be done most easily with a horse chestnut or a sycamore.

Section 4.—A series of mounted specimens to illustrate the life-history of a plant.

This section is very old, and is probably one of the first things thought of in connection with Nature Study. The favourite plants chosen are the bean and the mustard, but any quick-growing plant will give satisfactory results. In this section drawings connected with the specimens are most valuable.

Section 5.—Experiments in plant physiology.

Many students are fascinated with this branch of Nature Study, and probably it is one of the most instructive branches. Unfortunately it involves a knowledge of a certain amount of chemistry—for example, the iodine test for starch should be known—but a little instruction in tests will be amply repaid. The knowledge obtained by the performing of a few simple experiments on plants is enormous. The student should be encouraged, as far as possible, to devise experiments for himself. Numerous small text-books exist which describe these experiments; but it is generally agreed that much of the value of the work is lost when the student is allowed to use these books and does not work from his own ideas. Frequently, of course, he will be in difficulties, but a little questioning and judicious suggestion are all that is necessary.

Section 6.—Tree study.

Every student should be encouraged to take up this section. Two trees, at least, should be studied by each student during a year's work. He will find innumerable opportunities for observation and study—the size and shape of the tree, bark, twigs and winter buds, the same twigs in early spring, leaves, flowers and fruit, the texture of the timber, the method of branching, etc., all demand attention. The student should make drawings, in water-colours if possible, and the drawings should be kept side by side with his notes. He will then have a complete account of the work of the tree for a year. Afterwards he will be able to investigate

such things as the diseases of the tree, the insect life which infests it, etc.

Section 7.—A series of specimens, living or dead, to illustrate the life-history of an animal.

Some students do not take kindly to plant life, and possibly they may be attracted by this section. The choice of subjects is great—butterflies, moths, beetles, moles, earthworms, frogs, newts, toads are all suitable. The specimens may be preserved in alcohol or in a ten per cent. solution of formalin. A small aquarium should be available for the use of the students, who will then be able to keep some of their animals under continuous observation, and record every change. The exact time at which each change took place should be noted, and a series of drawings should be made.

Section 8.—An essay on the bird-life of the district, including detailed accounts of at least four of them.

As a general rule this will be found a most interesting section, particularly to students who live in towns. At first their work will be scanty, but as time goes on it is astonishing how their knowledge increases. Much original work may be done by the students—observations as to the nature and time of flight, the habits of the birds when nesting and rearing their young, changes of plumage, etc.—but great patience is required by the worker. An excellent piece of work was done by a Culham student this last year on the skylark, and his final notes and account, illustrated by original water-colour drawings, attracted much attention at the recent Nature Study Exhibition held at the college.

Section 9.—(*a*) An account, illustrated by maps, specimens, etc., of the work of a river; or (*b*) specimens, maps, etc., accompanied by a written description, to illustrate local geological formation.

This is rather a difficult section, and, of course, (*a*) is not always possible. In Section 9 (*a*) there is a tendency for students to refer to text-books, and this should be firmly discouraged by the master. The students will find that there is always sufficient material for them to work upon—for example, rate of current, shallows, formation of the banks at bends, the nature of the bed. Section 9 (*b*) can be taken up in most places, but as a branch of Nature Study it is probably too technical for the majority of students. Much of the necessary work can be done only by those students who have an elementary knowledge of, and a taste for, geology. Possibly few colleges are as well situated as Culham for work of this nature. The Thames, with the famous Culham Reach and Sutton Pools, is within a mile, and a sand pit and a clay pit within half a mile. In the latter the strata are most distinctly marked, and fossils are very numerous.

Section 10.—Original wall diagrams to illustrate any Nature lesson.

Section 11.—Original pen, pencil, or water-colour drawings, or photographs.

In these two sections Nature Study is correlated with drawing from two different aspects—the educational and the artistic. Wall diagrams, to be of any real value to the teacher, must fulfil certain conditions:—

(1.) The subject must be carefully chosen. Most frequently the wall diagram is used only when the actual object cannot be obtained. It would be waste of time to make a wall diagram of a poppy for use in a country school in June. (2.) Each part of the drawing must be of sufficient size to be visible to every boy in the class. (3.) The choice of medium and of tinted paper must be carefully made. All these points make a student think, and as a result his wall diagram does not consist of a mere pictorial representation of the object. But in Section 11 his artistic powers are allowed freer scope. He chooses his own subject and his own method of representation. For a photographer an enlarging camera will be found most useful. A good and reliable instrument to enlarge to twelve inches by ten can be obtained for about thirty shillings, and most college laboratories are now equipped with a dark room.

Section 12.—Notes of a lesson on a Nature Study subject.

Section 13.—A scheme of Nature Study for a town or a country school.

Both sections are directly connected with the student's training, and he ought to find his own observations most useful in helping him to draw up notes of a lesson. In preparing a scheme of Nature Study, his own difficulties and his methods of overcoming them should be extremely helpful. As a general rule, no difficulty is experienced in preparing a scheme for a country school, as there is always sufficient material at every period of the year; but the student's ingenuity will be taxed when he tries to prepare a scheme for a town school, and it is here that he will benefit most largely. Above all things, he should attempt to make his scheme a practicable one, such a scheme as he would be prepared to try if he were in charge of a suitable school. Possibly these two sections, together with Section 10, are the most useful for a student as far as his training is concerned.

Section 14.—An essay (illustrated if possible) on any living plant or animal.

Here, again, is a useful section, but frequently the value of the work is destroyed by reference to text-books. The essay should be the result of the student's unaided work. Almost any one can write an excellent essay on the primrose or the frog if he has an illustrated text-book by his side; but the matter becomes quite a different one when the writer has to depend upon his own observations. Probably bees provide one of the most suitable subjects for work in this section, and an "observation" bee-hive will be found useful.

Section 15.—A non-competitive section.

Here the students are allowed to give free play to their originality. Anything connected with Nature Study should be welcomed—a collection of freaks or sports in Nature, preserved specimens of the blossoms of trees, a series of specimens to illustrate "protective resemblance," etc.

This paper has been written in the first instance for students in training, but much of what has been written may be applied equally well to the scholars in elementary and secondary schools. In recent years Nature Study has come to be recognised as an essential subject in elementary schools, but as a general rule those in authority have not thought fit to introduce it into secondary schools. Some few secondary schools in the country do encourage their boys to study Nature by forming a Natural History Society; but these schools are in the minority, and the amount of work they do in connection with their societies is minute. This is a great pity, and something should be done to encourage the introduction of Nature Study into our secondary schools. Boys are Nature lovers by instinct, and all they require is a beginning. Once started, they will continue of their own free will, and only a little guidance

from the master is then necessary. The writer has recently had the pleasure of visiting two secondary schools, one in Somerset and one in Northumberland, in which the scholars take Nature Study as a subject, and it was very gratifying to note the keen interest which they took in their Nature work. He was told that the children looked forward to the rambles which they took with their master, and many of them continued the work in their spare time. It is certain that an exhibition, however small, would increase the interest of the children, and the results of their work in this direction would be reflected in all their other work.

N.U.T. NOTES.

BY ALLEN CROFT.

THESE startling words *should* have been printed at the head of a leaflet designed to draw public attention to the present state of the teaching "market."

"Parents Beware!"

But although the Education Committee of the Executive (of which I have the honour to be chairman) agreed to this form of admonition, an attenuated Executive could not, apparently, "screw up its courage to the sticking-place;" and so the leaflet will be entitled:—

RISKS OF ENTERING THE TEACHING PROFESSION.
COSTLY TRAINING AND THEN NO WORK.
A WARNING TO PARENTS.

During the past year or two I have observed from time to time that chairmen of Local Education Authorities have accused the N.U.T. of trying to diminish the supply of teachers. Up to a month ago there was no real foundation for the charge, although certain facts had naturally found their way into the public press, and questions been asked of the President of the Board of Education in the House of Commons. To-day I rejoice to think that, despite the obloquy and misrepresentation we shall doubtless incur from interested quarters, we have boldly decided to take every possible means of letting parents know the probable fate of promising sons and daughters entrapped by various alluring baits into the teaching profession. If the local Associations affiliated to the Union do their duty thoroughly, the parents of every child attending a secondary school in their area will have placed in their hands some astounding figures, which I venture to reproduce from the leaflet:—

"4,384 teachers left the training colleges in July 1908. THREE MONTHS LATER, at least 1,226 were without employment; and TWELVE MONTHS LATER, 259 of these were known to be still without employment. Of 3,492 students who left the training colleges in July 1909, 1,206 were still without employment in October 1909."

* * *

HERE is another pregnant paragraph from the leaflet:—

"The Board of Education will require your child to enter into a bond to serve for years as a teacher, but they will take no steps to find him employment. Yet they will prevent him, under penalty, seeking employment in another profession or trade; and should he find such employment, they will demand the repayment to the Treasury of the money expended by the State on his training. *The Board have recently secured the passing of an Act of Parliament to enforce this.*"

Supply of Teachers.

So far as can be ascertained by the intelligent outsider, the Board of Education makes no effort to deal scientifically with the all-important question of "supply." True it is that some three years ago it issued a report prophesying a "dearth" of ten thousand certificated teachers to-day; whilst it is common knowledge that in the early days of the introduction of the 1902 Education Act, the "failing line" for "acting teachers" was drawn so low as to be barely perceptible. Otherwise, it continues to encourage the establishment of training colleges (and I may as well express here my conviction that both from an educational and professional point of view the purely *local* training college is an abomination), and yearly allows the passage into the profession of over five thousand "non-collegiate" certificated teachers. I am glad to think that the Executive has decided to ask the President of the Board of Education to receive a public deputation, which will urge the abolition of this "acting teachers'" examination in the near future. Four or five years ago, when I first mooted this idea in the Executive, the correspondence columns of the *Schoolmaster* could find no terms too critical—not to say condemnatory and abusive—for my action. Fortunately I have lived long enough to see the abolition of the "acting teachers'" examination a main plank in the platform of the National Association of Non-Collegiate Certificated Teachers, whose central council recognise that this is the one step which can preserve the status of their members. The Executive will shortly issue a memorandum dealing with the whole question of training-college accommodation and supply of teachers; and inquiries are now being made as to the cost of training teachers by the various local education authorities. Unless I am very much mistaken, the iniquitous waste of public money in this direction will everywhere create a most profound impression and, possibly, sensation.

PHYSICAL EDUCATION.

REVISED SYLLABUS OF PHYSICAL EDUCATION.

"Gymnastic for the body and music for the soul . . . neither are the two arts of music and gymnastic really designed, as is often supposed, the one for the training of the soul, the other for the training of the body: the teachers of both have in view chiefly the improvement of the soul."—*Plato's Republic.*

ONE of the most striking and beneficial effects of the reorganisation of primary education consequent upon the 1902 Act is the attention which has been given to the physical well-being of school children.

The great advance in this phase of education becomes obvious when we remember that from the introduction of compulsory education in 1876 until 1904—the year in which the Board issued an official syllabus to be used in all schools—this subject was ignored except in large town centres. For a few years some difficulties were encountered owing to the fact that many teachers, trained under effete conditions, reluctantly found a place for what they regarded as another fad. During the last few years, owing to the training of the young teacher in the colleges and centres, and of the older ones at special classes organised by the local authorities, and also to the close attention and encouragement of the Board, marked progress has been made, so that

nowadays *Mens sana in sano corpore* no longer remains a shibboleth of the great public schools only.

None too soon, in view of the damning evidence of physical degeneration, which results from the unnatural conditions of the Lancashire cotton towns and other morasses of humanity, has the State stepped in to save the children. The Board takes a liberal view of the subject of physical education, as is testified in the following quotation from the prefatory memorandum :—

"It is now generally recognised that the physical health of the children lies at the root of education properly conceived. The object of every system of education worthy of that name will be the concurrent development of a sound character, an active intelligence, and a healthy physique. These qualities are to a great degree mutually dependent. It is undeniable that healthy physical conditions assist the development of the moral and mental faculties, and that adverse physical conditions may vitiate the otherwise well-directed efforts of the teacher. Physical education is thus essential to a sound intellectual training, and may be said to be fundamental in its effects on the individual. Proper nourishment, effective medical inspection, and hygienic surroundings will not, however, of themselves produce a sound physique. A further requirement is physical exercise. This may, no doubt, be promoted, especially in the case of country children, by a variety of means, but none o these is such that special physical exercises should be entirely dispensed with; and in the case of children whose lives are spent in town these exercises are indispensable, both for the development of the body and for the correction of the defects or evil habits induced by an unhealthy physical environment. In the case of all school children, therefore, physical exercises should be employed, but their use should always be carefully adapted to the needs and capacities of the children; there should, in short, be a direct relation between the three factors of nutrition, general health, and physical training."

The "serious inadequacy of existing" facilities for the treatment of physical exercises is referred to, and the Board, while admitting considerable progress, is anxious that there shall be a decided and definite advance without delay; and to this end a more adequate equipment of the teaching staff, both in the training colleges and the schools, is to be brought about.

This new syllabus will present no difficulty to those teachers who have mastered the original edition, although there are several "amendments and extensive revisions."

The syllabus is, generally speaking, based upon the Swedish system of educational gymnastics. The exercises have been selected and arranged in appropriate progression, and have been chosen for children of school age, and may be carried out without special apparatus.

So that the exercises shall be thoroughly enjoyed by the children—a feature which the Board emphasises as essential—the more exacting Swedish instructions are modified, and games and dancing steps are introduced. Care has been taken to avoid technical terms and descriptions. The Board desires to secure the careful and well-balanced cultivation of the physical powers of each individual child rather than mere conformity to gymnastic standards or the popular custom of class displays by selected teams. Great stress is laid upon the need for teachers to consider the principles embodied in the syllabus, and to this end some valuable general guidance is given as to the theory and practice of the subject.

A special appeal is made to the local authorities to assist the Board in their efforts to establish a system which will help to promote the "moral, mental, and physical development of the children in public elementary schools." Chapter I. deals in an interesting and useful way with the object of physical training, and with the resultant physical and educational effects; and it is pointed out that the "highest and best results of education cannot be attained until it is realised that mental culture alone is insufficient, and that physical exercise is necessary to the development not only of the body, but also of the brain and the character."

Some very appropriate information is given to show the application of physiology to physical exercises. A useful section treats of the hygiene of the subject, and shows the relation of lessons in physical training to school lessons. Lessons of twenty to thirty minutes three or four times a week are recommended, and these should never be regarded as a complete relaxation from school studies. The length of the lessons and the gradation of exercises need adjusting to the respective ages of the children. Music, as tending to mechanical performance, should not be used in the formal lessons for older children, but, on the other hand, should accompany the drill of the infants. The chapter concludes with these significant observations :—

"There are certain elementary necessities which are required for a healthy life. The child must be fed, sufficiently and suitably; it must be properly clothed, warmed, and housed; it must have enough sleep, rest, and fresh air, and the needful attention to personal hygiene and cleanliness. These in themselves, together with the natural walking, running, and jumping done by any ordinary child, will often suffice to produce a healthy and a well-developed body and brain, since even apparently simple actions, such as standing or walking, require the combination and co-ordination of many muscle groups. It is, however, always desirable, and in many cases necessary, to give further aid to the physical development. This may be done in two distinct ways: (1) by formal, set physical exercises, such as are given in the tables of this syllabus; and (2) by physical exercises having a more recreative or æsthetic character—for example, games and sports of various kinds and many varieties of dances."

The second chapter, which is most valuable, gives general directions to teachers; and in the succeeding chapters are descriptions of simple exercises and positions, together with marching, running, jumping, and breathing exercises, all of which are fully illustrated by good photographs. Then follow tables of exercises for three ages—Series A, 7–9 years; Series B, 9–11 years; Series C, 11–14 years. The book finishes up with a series of appendices, dealing with supplementary and classroom exercises, exercises for infants, and dress for girls.

The syllabus is now obtainable for ninepence. It is published by Eyre and Spottiswoode, and one copy at least should be supplied to each school.

*** **Pass on this number of**
THE PRACTICAL TEACHER
to a progressive friend.

A SCHEME OF CORRELATED HISTORY AND LITERATURE.

SCHEME FOR SECOND PERIOD—MARCH TO AUGUST.

BY MABEL A. BROWN.

History.	Literature.	Recitation.	Teacher's Reading.
March The story of Harold. Normandy and the Normans. William the Conqueror. The story of Hereward the Wake. The conquest of England.	*Harold.* By Lord Lytton. *Hereward the Wake.* By Charles Kingsley.	*William the Conqueror.* By Charles Mackay. *Battle of Hastings.* By Bennett. *The Curfew Song of England.* By Mrs. Hemans. *The Norman Baron.* By Longfellow.	Roger of Wendover's *Flowers of History.* *Anglo-Saxon Chronicle.* *Norman Ballads and Romances.*
April— England under Norman rule—William II. Henry I.—Story of the *White Ship.* Anselm, Archbishop of Canterbury. Story of Becket the Martyr. The good reign of Henry II. Plantagenet.	*Ivanhoe.* By Scott.	*Death of William Rufus.* By R. F. Murray. *He Never Smiled Again.* By Mrs. Hemans. *St. Thomas of Canterbury.* By J. Edward Parrott.	Giraldus Cambrensis. Roger de Hovenden's *Chronicle.* Eadmer's *Life of Anselm.* Tennyson's *Becket.*
May— Richard the Lion Heart at home and abroad. The story of the Crusades. How we got Magna Charta. Three great men—Stephen Langton, Hubert de Burgh, and Simon de Montfort.	*The Talisman.* By Scott. *The Betrothed.* By Scott. *Robin Hood.* *King John.* By Shakespeare.	*Richard I. at the Bier of his Father.* By Mrs. Hemans. *Crusaders' War Song.* By Mrs. Hemans. *Robin Hood.* By Keats. *Allan a Dale.* By Scott. *Sherwood.* By Alfred Noyes.	*Tales of the Middle Ages* (Horace Marshall). *Tales of the Crusades.*
June— Edward I.—the Hammer of the Scots. The story of Llewellyn and his fight for Wales. The story of William Wallace. The story of Robert Bruce. Edward's "complete and model" Parliament.	*Tales of a Grandfather.* By Scott. *Bruce.* By Barbour. Froissart's *Chronicle.*	*Bannockburn.* By Burns. Selected Scotch ballads. Extracts from *Marmion* and *Lady of the Lake.*	Percy's *Reliques.* Froissart's *Chronicle* (Blackie). Gray's *The Bard.* Scott's *Lay of the Last Minstrel.* Scott's *Marmion.*
July— The Black Prince—Crecy and Poictiers. Story of Geoffrey Chaucer. England in the Middle Ages. John Wiclif and his reforms. The Peasants' Revolt under Wat Tyler.	Froissart's *Chronicle.* Selected prose tales from Chaucer's *Canterbury Pilgrims.*	*The Song of the Bow.* By Conan Doyle. *Song from Wat Tyler.* By Southey. *Crecy.* By J. Edward Parrott.	Langland's *Vision of Piers Plowman.* Froissart's *Chronicle.* Chaucer's *Canterbury Pilgrims.*

THE DANISH INVASION (*Continued*).

Last month's work ended with the death of Alfred. The scheme for February covers the period between 901 and 1042, the period of continued Danish invasion, and, finally, conquest and settlement in the reign of Canute. During this short period twelve kings sat on the throne of England. Their reigns may be summarised as follows:—

901. Edward the Elder.—Great help rendered by the Lady of the Mercians. Reduction of the Danelagh and Wales. Relations with Scotland.

925. Athelstan the Glorious.—Great battle of Brunanburh. Connections with the Continent through intermarriages.

940. Edmund, doer of great deeds.—Crown of all England. Alliance with Malcolm of Scotland.

946. Edred.—Uneventful reign, marked by the rise of Dunstan.

955. Edwy.—Reform in the Church. Banishment of Dunstan.

959. Edgar the Pacific.—Height of Anglo-Saxon prosperity. Conciliation of Danes. Dunstan, king's chief adviser.

975. Edward the Martyr } Sons of Edgar.—Dis-
979. Ethelred the Unready } astrous reign of Ethelred (*rede* means counsel). Great invasion of Danes in 984. Battle of Maldon, 991. Danegeld.

1014. Edmund Ironside } Period of real conquest and
Canute the Dane } settlement. Canute's wisdom in ruling as an English king and statesman. "The Emperor of the North." Norway and Denmark added.

1035. Harold } Sons of Canute.—Rise of Godwin
1040. Harthacnut } during these two reigns.

1042. Edward the Confessor.—The crown returns to the West Saxon line.

Brief Notes on this Period.

Note the gradual consolidation of England during this period, also the connection with Scotland. Final submission in 924 to Edward the Elder of the Welsh of Strathclyde, the Danes of Northumbria, and the Scots, shown by the following extract from the *Anglo-Saxon Chronicle*: "And him chose they to father and lord, the king of the Scots and all the folk of the Scots, and all that

in Northumbria dwell.....and eke the king of the Strathclyde Welsh and all the Strathclyde Welsh." Edward's title, Rex Angul-Saxonum, shows the character of his conquests and points to a unified realm. Athelstan's title was Basileus of all Britain; and we know that Welsh princes and Danish earls sat in his Witan. Edred called himself Cæsar totius Britanniæ, thus keeping the claim of English rulers to imperial powers. Canute acquired still further sovereignty, much of which, however, was lost at his death through the incapacity of his successors.

This period is also marked by the conspicuous figure of *Dunstan*, Abbot of Glastonbury, where he founded a great school, almost a university for England. He was a real statesman, keen, energetic, enthusiastic, iron-willed, powerful, bending men to his will. Made Archbishop of Canterbury and Chief Adviser to the Crown, Dunstan's great aims were to make England a great power, and to make the Church the greatest power in England; for he regarded the Church as the backbone of all politics and the greatest civilising and teaching force. "Let every priest learn a craft" was his motto, and arts and crafts were sedulously cultivated in his school and in the monasteries. He carried on the wise policy of Alfred with regard to education.

Extract from *Anglo-Saxon Chronicle*: "God granted to him (Edgar) that he should live in peace the while he lived. The Archbishop's wisdom taught justice to the king; the king won the mercy of God; and God's mercy gave abundance of all good things to the people."

Literature.

In addition to the literature given last month, I may mention *Told by the Northmen*, published by Harrap at 1s. 6d., a very useful collection of Scandinavian myths, extracts from which, entitled *Tales from the Eddas*, may be bought for 9d. These stories are of great help in assisting the children to understand the character and temperament of the Danish invaders—their bravery, fearlessness, ruthlessness, and disdain of consequences; their religious beliefs and their customs, many of which are handed down in some shape or form to the present day.

There are two famous poems of this period, war songs of the victories at Brunanburh and Maldon. The former was translated into English by Tennyson. The MS. of the latter was destroyed by fire in 1731; fortunately a copy had been made and printed five years before, but the original is lost. Another original MS. of this period is that of Dunstan's at Canterbury, and at the Bodleian there is an interesting picture of himself at the feet of Christ. Suitable tales for the younger children are two entitled "From Joy to Sorrow" and "The Boy Chief," from *Stirring and True*, published by Collins at 6d.

For teacher's reading, *Harold*, by Lord Lytton, and *Hereward the Wake*, by Kingsley, which will be used next month, may be begun now. Both of them give vivid pictures of the Danish spirit and character.

Ballads of British History, I., published by Nelson at 3d., contains the poem "Canute." Many other suitable poems for recitation were recommended last month. Next month the scheme will be given as usual, worked out in grades.

CHRISTIAN NAMES.

BY RUBY K. POLKINGHORNE, B.A., L.C.C. STOCKWELL SECONDARY SCHOOL.

ONE good way of encouraging children "to love lovely words," to see the stories and poetry in them, to understand the history of language, and, incidentally, the history of men and women too, is to give them some lessons on what we call Christian names. Let them try to answer these questions: Why is one name popular, another disliked, another forgotten? Why should one flourish throughout Europe, another in one country only, another around some small district only? Answers to these questions teach both history and morality.

The following account of Christian names is very incomplete, and only in few cases are the stories referred to which have made the names famous—though nearly every name has a story attached worth the telling. Further interesting and suggestive information may be found in Charlotte Yonge's *History of Christian Names*, Mrs. Jamieson's *Sacred and Legendary Art*, Mrs. Rundle Charles's *Martyrs and Saints of the First Twelve Centuries*; in dictionaries and various histories.

Individual names are much older than surnames, and arose:—

1. From some peculiarity or defect, colour of complexion or hair, etc.: for example, Esau (Heb.), hairy; Don (Kelt.), brown; Blanche (Teu.) fair; Nigel (Lat.), black; Balbus (Lat.), stammerer; Doreen (Kelt.), sullen; Gladys (Lat.), lame; Paul (Lat.), small.

2. From the qualities desired for the child: for example, David (Heb.), beloved; Vida (Heb.), beloved; Philip (Gr.), lover of horses; Amy (Lat.), beloved.

3. From a weapon, jewel, or flower. Names of flowers indicate generally that the nation which uses them is an imaginative one. They were not used by the ancient Greeks or Romans as individual names: for example, Gar (Teu.), spear; Marguerite (Gr.), pearl; Rhoda (Gr.), rose; Susanna or Susan (Heb.), lily.

4. From an animal: for example, Deborah (Heb.), bee; Jonah (Heb.), dove; Columba (Lat.), dove; Ursula (Lat.), bear; Bran (Kelt.), raven; Dorcas (Gr.), gazelle.

5. Names dedicating the child to the Divinity. These names are common in Scripture: for example, Ishmael, heard of God; Jessie, grace of God; Elijah, God the Lord; Artemidorus (Gr.), gift of Artemis.

6. A few names indicate sorrow when the child was born. Such names are not found among a light-hearted race like the Greeks, so the two examples are taken, one from the deep-feeling Hebrews—namely, Ichabod, the glory is departed—the other from the quick-feeling Kelts—Una, famine.

The invention of Christian names usually takes place in the early stages of a people's history. As time passes, established names become more popular, and the child is called after the great men or women who have lived before him.

Names from the Hebrew.

These names are so well known, and are so often well explained, that only a few will be noticed here. The oldest name of all, Adam, means the red earth, and its first owner called his wife Eve (life), as she was "the mother of all living."

Sarah, or Sara (princess), and Rachel (ewe) are two fine Hebrew names that are not very popular. Dante in his *Divine Comedy* makes his Rachel, with her beautiful eyes, the type of heavenly contemplation; therefore he represents her ever gazing at the mirror that reflects heavenly glory. This name was specially loved in Puritan days.

When Rachel, after long waiting and hoping, had a son, she called him Joseph, from a word signifying addition, because she hoped that God would give her yet another child. Joseph, in spite of his lovable character and interesting history, has not many namesakes at the present day. His name was probably not used as an appellative in Europe until the seventeenth century. One great man of letters bears this name—Joseph Addison. The Arabs love its use, for even to-day many are called Yussuf (Joseph). Josephine is its feminine form, invented by the French. The unfortunate and famous Empress Josephine made the name particularly popular in France, where there were in her time many Fifines and Finettes.

Mary (bitter) and Elizabeth (God's oath, God has sworn) are more popular names. The first woman to

bear the name of Mary—most honoured among those of women—was the sister of Moses and Aaron, who led the song of the Israelites when they saw their foes dead on the sea-shore.

That the name is liked may be seen by its many contractions and endearments—Maria, Marion, Marie, Molly, May.

Elizabeth was contracted by the French into Isabella. Our King John married a lady called Isabel, and so the name was brought to England.

Hannah (grace) gives us Anna, Anne, Nancy, Annette.

Names from the Greek.

Each Greek had but one name, which was given to him by his father on or before the tenth day of his life, on which occasion a festival of some sort was held. Surnames were unknown. Families used, however, to mark themselves by recurring constantly to the same name or by adding the termination idas (son of) to the father's name, and giving this slightly altered form to the son—for example, if Leo was the father's name, the son's would be Leonidas. A like custom prevailed among the old English.

After the Romans had subdued Greece, Latin and Greek titles became mixed, and the custom of surnames arose and prevailed.

The Greeks did not often call their children after their gods and early heroes (for example, Zeus, Hera, Apollo, Achilles, etc.—names often inexplicable to themselves), but formed names from epithets in the spoken language—for example, Agathos (good), Alexandros (helper of men), Leander (lion man), Laodamas (people-tamer). Phyllis (a green leaf) has a story attached to it. She was a beautiful damsel, who waited many days for her lover to return. He did not keep his promise, and she hung herself. The gods, in pity, changed her into an almond tree. Nicolas (victory of the people) and Andrew (man) are typical Greek names. Stephanos (crown). The first little Greek to bear the name of Stephen was perhaps so called by some happy family whose father had returned with the parsley or pine-leaf crown of victory upon his head. The name is an interesting one in history.

Greek Christian Names.—These names, formed from the Greek language, were used by the early Christians in different parts of Europe, but not by the ancient Greeks. Theodora means divine gift. The West preferred this name reversed as Dorothea. It is the beauty of the well-known legend of St. Dorothea that has made her name so great a favourite—we are always meeting Dorothy, Dolly, and Dora.

In the heathen days of Greece, Eirene (peace) was personified and revered as a goddess; in Christian times it was formed into a name, Irene. Many beautiful stories of saintly heroism are connected with the names of Barbara (stranger), Agnes (pure), Katharine (pure). The pretty name Theresa is a harvest name, for it means a reaper.

Names derived from the Greek are generally readily explained by a Greek dictionary—for example, Cyril from Greek *kurillos*, lordly; George from *georgos*, husbandman. Before leaving Greece we must mention two early Greek heroines who have to-day many namesakes. One was famous for her beauty—Helen (light), and from her name we get Elaine, Eleanor, Nelly, Lina, Ellen; the other for her faithfulness—Penelope (weaver). Their histories are well known.

(*To be continued.*)

AN INTRODUCTION TO BRITISH DECIMAL WEIGHTS AND BRITISH DECIMAL MONEY.

BY P. MADDEN, RETIRED FIRST CLASS HEAD TEACHER, SCHOOL 253, AT MELBOURNE, AUSTRALIA.

Plan for Decimal British Coinage.

1. FIRST make cent piece = 2½d., or 10 farthings. Let people get well acquainted with it for a few years—it will save carrying about bronze. Two cents will be 5d., four 10d., five will be 1s. 0½d., ten equal 25 pence.

2. Make the sovereign heavier, so that its value may be 250 pence, or 1,000 farthings.

3. Get the present florin altered so as to make it worth 25 pence, or 100 farthings. Either retain its name when altered, or call it British dollar.

4. Remember that the farthing, the least in value of the British coins, is a very useful coin. The average number minted yearly is 3,342,720. We will simply change its name.

5. Retain our pennies and half-pence as they are; they are so useful in regulating small values that they must be preserved. One million pennies are used every day on the road cars and tubes in London alone.

6. When everything is going nicely, new shillings and new sixpences can be made, the first worth ½d. more than the old one, the second worth ½d. more.

7. The correct names of these latter at school will be half dollar and quarter dollar, to preserve the natural power of halving.

8. The money table then will be as follows:—

1 farthing	= 1 mil.	=	¼d. =	1 mil.	Coins: Guinea, Half Guinea, Dollar, ½ Dollar, ¼ Dollar, Cent, Penny, Halfpenny, & Farthing or Mil.
10 mils	= 1 cent	=	2½d. =	10 mils.	
10 cents	= 1 florin	=	25d. =	100 mils.	
10 florins	= 1 guinea	=	250d. =	1,000 mils.	

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3. G will stand for the gold coin in front instead of £. Very seldom in the price of any articles will there be any but two decimals after G or guinea.

4. After the dollar or florin there can only come two decimals. The figures from left to right when there are three after G may be read right through as farthings.

5. The answer, such as G2·345, if divided right through will give £ s. d. of present money.

6. Any and all sums of present money can be changed into decimal notation by simply reducing to farthings, pointing off three decimals and placing G in left front.

7. All sums containing pounds alone will be changed to guineas by deducting 4 per cent. from their number, because £100 = 96 guineas.

8. Interest tables or insurance tables will not need alteration; call the figures guineas, as 5 guineas interest on 100 guineas is the same rate as £100 at 5 per cent.

Decimal British Weights.

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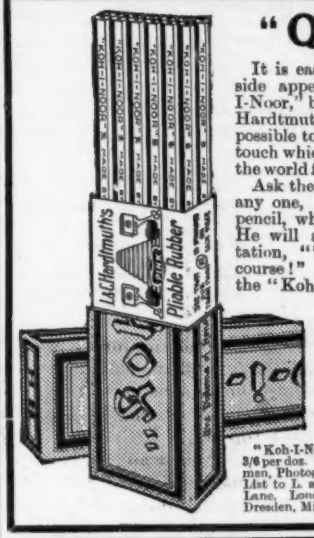

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think the British people and the people of the Empire will accept my simple scheme of rearranging their weights on a plan that will give satisfaction to both wholesale and retail dealers, as well as easy tables and easy plans of calculation to their children.

My plan preserves and retains the pound weight, the most popular and best-known weight in the world, as standard, without any alteration. More than that, it preserves and retains as weights the same half-pound, quarter-pound, and one-eighth-pound weights we now use, and intends to perpetuate them. It also preserves all iron weights heavier than the pound, and only destroys the present ounce and dram weights.

If the French metric system were forced by law upon us, the total destruction of all our weights and measures would immediately follow, and all our people, from the highest to the lowest, and from the poorest to the richest, would be worried either personally or through their servants, with strange names and alteration of prices in even the simplest commodities.

Think of the expense such an alteration would be to the nation in making and distributing new weights and measures. Besides our own country, this change would affect all the great and little parts of the British Empire. Conclusion: We should no more change our British standards than we should change our language.

Fortunately, a certain Henry, King of England, fixed our pound weight in order that his subjects would have good weight in their provisions at 7,000 grains to the pound. This enables me to place before the British a simple plan for a slight alteration that will not injure, and yet will enable us to make calculations with weights just as we do with the simple rules, and that will displace for ever the trouble that not only our children but grown-up people have with the different standards used for tons, cwts., qrs., lbs., ozs., and drams.

My proposed plan will enable the new or decimal tons to be placed in the thousands period, and cwts., stones, and lbs. to be booked in the units period. With respect to the three new weights to be created to replace those destroyed, the new ounce will be heavier than the old one, and ten will make a pound. The new dram will be much heavier, but ten will make a new ounce. The new scruple will be one-tenth of the new dram, and will complete the decimal scale. The figures for these ounces, drams, and scruples will follow in order after the pounds, and make a new period, just like simple notation. The four simple rules will work all the weight questions. No reduction will be any more required; only just place the figures in order. The table and plan are here annexed:—

Table of Weights.	Plan.	lbs.
10 scruples = 1 dram.	7 grains = 1 scruple	= ·001
10 drams = 1 ounce.	70 grains = 1 dram	= ·01
10 ounces = 1 POUND.	700 grains = 1 ounce	= ·1
10 pounds = 1 stone.	7,000 grains = 1 POUND	= 1·
10 stone = 1 cwt.	10 pounds = 1 stone	= 10·
10 cwt. = 1 decimal ton.	10 stones = 1 cwt.	= 100·
	10 cwt. = { 1 decimal ton. }	= 1000·

The simplest and best plan would be for all weights to be declared in pounds, and then, if the people like, to continue the old names on the decimal quantities now given, as I can see no harm or danger can arise from calling 1,000 pounds a ton or 100 lbs. a cwt.

Weights booked in figures on this scale, as 3,456·789 lbs., may be read as 3 decimal tons (or 3 new tons), 4 cwt., 5 stones, 6 lbs., 7 ounces, 8 drams, and 9 scruples, or as 3 tons, 456 lbs., 789 scruples. Any weight expressed in this decimal form, as 7 tons, 146 pounds, and 13 scruples, has only to be placed in order, thus—7,146·013 lbs.—to be completely reduced, and for scientific men any and all weights on this scale have only to be multiplied by seven to make grains, and to place any number of grains on this scale they have only to be divided right through by seven to appear as so many avoirdupois pounds or decimal weights of pounds, which this scale is constructed to give.

Grocers and many other dealers seldom descend to weights below half an ounce, or 1/32nd of a pound; for these four new small weights will be sufficient. For those who must have lesser weights two more will bring them to 1/100th of a pound, while four more will weigh down to 1/000th of the pound.

New Weights.

1.	3 ounce weight = ·3 lb.	6.	1 dram weight = ·01 lb.
2.	1 ounce weight = ·1 lb.	7.	½ dram weight = ·005 lb.
3.	½ ounce weight = ·05 lb.	8.	¼ dram weight = ·0025 lb.
4.	¼ ounce weight = ·025 lb.	9.	3 scruples = ·003 lb.
5.	3 dram weight = ·03 lb.	10.	1 scruple = ·001 lb.

Both Troy and Apothecaries' weight can be placed on this scale. Troy pound = ·822-6/7, and the ounce ·068-4/7. The sevenths are grains.

These new ounces, 10 to the pound, will be of immense advantage to customers who purchase in small quantities. The new ounce will be 60 per cent. heavier than the present one. The great advantage it will give will be that in 10 different prices between 2½d. per lb. and ending 25 pence it will give exact ounce weights and exact money, and at each of these prices 1, 2, 3, 4, 5, 6, 7, 8, or 9 ounces would give exact price without remainders; whereas the 16 ounce to the pound only gives six different prices ending at 25 pence in which exact weight in ounces agrees with exact money. At the same time, the present half and quarter pound being retained enables this new plan to have exact money wherever our present plan gives it.

I attach the plan of the new decimal weights. The present pound is halved three times in succession. The new ounce is halved twice in succession and a new 3 ounce weight added. The ½ lb. makes 5 ounce weight. The new dram is halved twice and 3 dram weight added. Of scruple weights, a 1 and a 3 are only needed because the ¼ dram makes 5 scruples. With the scruple weight the decimal scale ends.

With a decimal money scale from one farthing upwards the weights and money will ascend in the same ratio.

"THE PRACTICAL TEACHER" COMPOSER.

In response to several requests, the Editor has pleasure in furnishing a few particulars concerning the professional career of Mr. F. H. Squires, who is rapidly making a name for himself as a composer. After gaining his diplomas at the Royal College of Organists, Mr. Squires was appointed to the Parish Church at Dartford, and later to St. Paul's, Maidstone. The post of organist at St. John's, Paddington, falling vacant, he was examined by Sir Frederick Bridge on the organ in Westminster Abbey, and, as a result, gained this important appointment, which he now holds.

Our readers have had frequent opportunity of judging Mr. Squires's quality as a composer. A few years ago one of his compositions was performed in Westminster Abbey and King's College, Cambridge. He is in great demand as a teacher of singing as well as of the piano and organ; and now that he has become a regular contributor to *The Practical Teacher* will doubtless follow in the footsteps of so many others who have contributed to its pages, and rise to a high position in his chosen profession.

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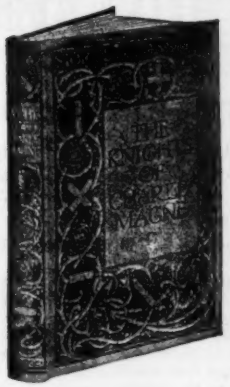

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The Editor's Bookshelf.

A NEW HISTORY OF LITERATURE.*

AT last we have a school text-book of English literature written on the assumption that the reader is *not* intimately acquainted with every book that was ever written in our mother tongue. Dr. Long's new volume has three specific aims:—

"The first is to create or to encourage in every student the desire to read the best books, and *to know literature itself rather than what has been written about literature.* The second is to interpret literature both personally and historically.....The third aim is to show, by a study of each successive period, how our literature has steadily developed from its first simple songs and stories to its present complexity in prose and poetry."

We are most keenly interested in the first of the three aims mentioned above. However brilliant a "monograph" may be, its excellence is lost upon a young student. Dr. Long can be brilliant enough when he chooses, but he also gives us paragraphs like this, which for our school purpose are more to the point:—

"*The Ring and the Book* is Browning's masterpiece. It is an immense poem, twice as long as *Paradise Lost*, and longer by some two thousand lines than the *Iliad*; and before we begin the undoubted task of reading it we must understand that there is no interesting story or dramatic development to carry us along. In the beginning we have an outline of the story, such as it is—a horrible story of Count Guido's murder of his beautiful young wife; and Browning tells us in detail just when and how he found a book containing the record of the crime and the trial. There the story element ends, and the symbolism of the book begins. The title of the poem is explained by the habit of the old Etruscan goldsmiths, who, in making one of their elaborately chased rings, would mix the pure gold with an alloy in order to harden it. When the ring was finished, acid was poured upon it; and the acid ate at the alloy, leaving the beautiful design in pure gold. Browning proposes to follow the same plan with his literary material, which consists simply of the evidence given at the trial of Guido in Rome in 1698. He intends to mix a poet's fancy with the crude facts, and create a beautiful and artistic work.

"The result of Browning's purpose is a series of monologues, in which the same story is retold nine different times by the different actors in the drama. The count, the young wife, the suspected priest, the lawyers, the Pope who presides at the trial—each tells the story, and each unconsciously reveals the depths of his own nature in the recital. The most interesting of the characters are Guido, the husband, who changes from bold defiance to abject fear; Caponsacchi, the young priest, who aids the wife in her flight from her brutal husband, and is unjustly accused of false motives; Pompilia, the young wife, one of the noblest characters in literature, fit in all respects to rank with Shakespeare's great heroines; and the Pope, a splendid figure, the strongest of all Browning's masculine characters. When we have read the story as told by these four different actors, we have the best of the poet's work, and of the most original poem in our language."

We have quoted this at length, because it is a good sample of Dr. Long's method. It makes one who has not read *The Ring and the Book* wish to read it, and this is the best of all possible results of the use of a handbook of English literature. At the same time, even this short sketch is critical, and will not lead the young student to disappointment. After all, as Dr. Long wisely remarks, "While youth delights in Tennyson, manhood is better satisfied with Browning."

We should, however, do our author an injustice if we conveyed the impression that his book is one which will not help and guide the well-read student of our glorious literature. The teacher who knows the poets and prose writers of England turns with interest to the reviews of his favourite authors in order to test the value of his own private impressions. What does he get? Sentences like these:—

"Macaulay alone among critics voices a fault which all who are not poets quickly feel—namely, that, with all Spenser's excellences, he is difficult to read."

In an age of pretence we thank the author for that word.

"Bacon was apparently one of those double natures that only God is competent to judge."

"To strip off the mask of vice, to show its ugliness and deformity, but to reveal virtue in its own native loveliness—that was Addison's purpose."

"Burke had a superb faith in the compelling power of the truth."

And so on. But we leave the reader to enjoy the book. It will please him by its consistent clearness, encourage him to read further, and test his reading in the best possible manner.

* *English Literature.* A text-book for schools. By William J. Long, Ph.D. (Ginn and Co.).

SOME FRENCH GIFT BOOKS.

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Le Dernier des Castel-Magnac, par H. de Charlieu; ouvrage illustré de 48 gravures par Ed. Zier. (Nouvelle Collection pour la Jeunesse.)

THE generous format and resplendent binding of this series is now well known, while the adaptation of the matter to the reading of young persons is no less conspicuous. The story told in the present volume is interesting, not to say exciting. We begin with a mysterious attempt to murder, which results in the permanent loss of memory of the victim. An innocent man is condemned to lifelong transportation for the crime, but eventually escapes and returns to France. Then we have no lack of excitement in the chapters which describe his concealment in Paris, and the clever methods of an ex-detective in securing his safety, and ultimately his rehabilitation through the discovery of the real criminal. The dramatic scene in which the latter is made to confess his guilt, while at the same time the victim is restored to memory through the shock arising from the "reconstruction" of the attempted assassination, is a piece of vigorous writing. The book will form a most acceptable gift to any boy whose knowledge of French is a little more than elementary, and the pleasure of its perusal will certainly improve his mastery of the language.

Poucette, par Pierre Maël; ouvrage illustré de 48 gravures par Dutriac.

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detail, through many domestic scenes; and the course of the story involves a study of a new type of school—"L'Ecole du Grand Air"—the description of which is not without some humour, apparently unconscious. The tale ends with the return of prosperity, and is pleasantly and simply told. The character of the governess, who acts throughout as a domestic Providence, is finely drawn. The volume will appeal chiefly to senior girls, for whom it can be warmly recommended. In size and style it is uniform with the preceding.

Petite Nièce, par Mme. Chérou de la Bruyère; ouvrage illustré de 38 vignettes par Dutriac.

Here we have an *enfant terrible* to be civilised, and the story of her reform is full of interesting and often amusing incidents. The little orphaned heiress from Ceylon descends upon an uncle and aunt in Paris—the former a recluse who lives among his books—with a tame elephant and a Cingalese attendant; and there are numerous complications in consequence. The incidents are often original and unexpected, though not transgressing the bounds of possibility; and the characters are interesting, and for the most part pleasant company. The story is a pleasant one to read, and will be enjoyed by any girl—or any boy, for that matter—who has a practical acquaintance with French. The volume forms one of the handsome "Bibliothèque Rose Illustrè" Series.

NEW EDUCATIONAL WORKS.

School Algebra. Part II. By W. E. Paterson, M.A., B.Sc. (Clarendon Press.)

PART I. of Mr. Paterson's *Algebra* has been noticed in our columns; this second part deals with the higher parts of the subject except Probability, and includes a short account of the Theory of Equations. The progressions occur comparatively late; it is a pity authors always postpone this easy and interesting section.

The whole of the work occupies considerably less than half the space devoted to the same syllabus in the text-books in general use, and thus limited we imagine the author was frequently in doubt what to include and what to omit. We have failed to discover his principle of selection. Among the numerous omissions we should consider many of more importance than some of the articles included. A proof is given of Vandermonde's Theorem; a page is devoted to derived functions, although the only application is to show that a rational function is continuous, which can be proved in a more elementary manner. Again, Horner's method of finding a numerical root of an equation is given, and in an example a root (which conveniently lies between one and two) is found to three places of decimals—much too tedious work for boys. On the other hand, an additional half page would have made many articles comparatively useful.

The book may serve for a preliminary canter through the work, but most pupils who read so far as continued fractions require a more thorough treatment with a view to university scholarships or London examinations. Continued fractions occupy five pages and theory of numbers four pages.

There is much that is unsatisfactory in text-books on higher algebra. A comparison of Todhunter's book with more modern school books will convince any reader how little later writers have done to simplify the harder parts of the work. We cannot help regretting that Mr. Paterson has let slip the opportunity of rewriting in a thorough manner the more advanced work.

In the chapter on "Convergency" the comparatively recent term "oscillating series" is introduced, but only two tests of a series are discussed. The introduction to "Limiting Values" is good, but the proofs of the fundamental theorems are not very convincing, and might well have been omitted. The definition of a recurring series is misleading. A short sketch of determinants is given; it should come earlier: the work is easy, fascinating, and useful. We miss cross multiplication, which would have simplified several illustrative examples—for example, page 356.

Quite rightly the author bases his work on Theory of Equations on the axiom that every equation has one root; it would have been well to have noted that the co-efficients must be numbers, simple or complex, and that the axiom can be proved.

The Elementary Principles of Graphic Statics. By Edward Hardy. (London: Batsford.)

This is a second edition, revised and enlarged, of a work previously recommended to students studying building construction or bridge work. The new matter includes sections on the reaction of walls under oblique thrusts, bending moments under oblique thrusts, and wind pressure on pitched roofs. The diagrams, 232 in number, are very clear, and the explanations are concise and sufficient. We can thoroughly recommend the book to technical students, especially to candidates for the various Board of Education examinations.

The Elements of Geometry in Theory and Practice. By A. E. Pierpoint, B.Sc. (Longmans, Green, and Co.)

This book is dated from Lucknow, India. The author has based his arrangement on the Mathematical Association Committee's report of 1902.

The book is divided into three parts, which cover Euclid I.–IV., plus scale drawing, graphs, field work, pattern drawing, and simple solids. Each part contains (1) an experimental section, (2) a theoretical section, (3) a practical section.

In (1) no formal definitions are given. We find, for example: "If the arms of an angle are square with one another the angle is called a right angle," which is not too satisfactory. The definitions are detailed in (2), and collected with axioms and postulates at the end of the book. In the experimental stage most of the usual propositions are arrived at by a measurement; the pupil is then instructed to learn the enunciation by heart.

Throughout angles are denoted by Greek letters, and a variety of abbreviations are used. The diagrams are white on black. There are 1,259 exercises, and many "questions for examination," to which the answers are usually given. Thus:—

"Why are a certain number of axioms necessary? (To give grounds for deducing other geometrical truths that are not so self-evident.")

References to the source of a question may be useful, but the following border on the humorous:—

"The sum of the angles of a quadrilateral is 4 right angles"—(Bomb. Matr.).

"The medians of a triangle are concurrent"—(Calc. F. A.).

"Any 3 sides of a quadrilateral are greater than the fourth"—(Beng. Eur. Schls. Mid.).

The author has absorbed some of the atmosphere of philosophy and imagery of our Eastern empire: "A bubble or a cloud is quite as much a solid geometrically as a lump of lead." "Is a shadow a surface?" An English child would find this next quotation dreadful: "The converse of a theorem whose hypothesis is made up of several distinct hypotheses, and whose conclusion is made up of several distinct conclusions, is obtained by interchanging one of the conclusions and one of the hypotheses."

Elementary Mechanics of Solids and Fluids. By A. C. Jones, M.A., Ph.D., and C. H. Blomfield, M.A., B.Sc. (Edward Arnold.) 366 *pages. Price* 4*s.* 6*d. (with answers).*

We are grateful to the authors of this work for one more example of the increasing tendency of modern teachers of mathematics to treat what were formerly *distinct* subjects as inseparable units of *one* subject.

Messrs. Jones and Blomfield present to us statics, dynamics, and hydrostatics so ordered that they may conveniently and with advantage be studied together.

By judicious division and arrangement of the various sections many of the difficulties of teaching the beginnings of hydrostatics have been overcome. For instance, pressure follows a consideration of force—a natural sequence. The student is, moreover, spared several long and wearisome sections—for example, machines. These the authors introduce each in their turn as soon as the laws upon which its use depends have been explained. For example, the lever and similar machines follow moments and parallel forces.

Throughout the book the number of formulæ is reduced to a minimum by careful development of the subject by numerical examples, thus compelling the student to rely on fundamental principles for his solutions. This is most noticeable perhaps in the chapters dealing with Centre of Gravity and Impact. In each of these certain portions, which experience shows to be seldom understood by young pupils, have been omitted, without in any way impairing the usefulness of the book for examination purposes, nor materially lessening its scope. In the former the position of the centre of gravity of bodies such as a solid hemisphere is merely stated without proof for use in solving examples. In both chapters carefully-selected questions are

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Common difficulties, such as occur in dealing with questions concerning bodies falling freely, are clearly explained by means of examples worked out in full. In these appreciative readers of the "Query Column" will doubtless recognise the handiwork of the Query Editor.

Graphical work is made an integral part of the subject, and a fair proportion of problems with diagrams are included for solution.

The many illustrative examples will prove excellent aids to a thorough understanding of mechanics and of considerable use in working the exercises. Of these there is an abundance. Many of them are entirely new, and others have been chosen from the examination papers of various bodies, such as the Delegates of the Oxford Local Examination, the Cambridge Local Examination Syndicate, the Oxford and Cambridge Schools Examination Board, the Senate of the London University, etc. For these examinations this work is to be recommended to teachers, and also to tutors preparing students for pass examinations at the universities.

The text and diagrams, which are well drawn, are clearly printed. Important statements and formulæ are in thick type, and there appears to be few errors. In one or two cases the diagram and letterpress are not on the same page, but these are exceptions to the general rule.

French Prize Competition.

1. All French translations **must be received not later than February 7, 1910,** and addressed to:—PRIZE EDITOR, Office of *The Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the *coupon* which appears on the Back Wrapper page of the current number. One coupon must be sent for each entry.
3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—

Contenter le public, s'en faire estimer est fort bien ; il n'y a nul mal assurément, et Laffitte a raison de se conduire comme il fait, parce qu'il a besoin, lui, de l'estime, de la confiance publique, étant homme de négoce, roturier, non pas duc. Mais le point pour un ministre, c'est de rester ministre ; et, pour cela, il faut savoir, non ce qui s'est fait à Lyon, mais ce qui s'est dit au lever, dont ne parlent pas les journaux. La presse étant libre, il n'y a point de conspiration, dites-vous, messieurs de gauche. Vraiment on le sait bien. Mais, sans conspirations, comment sauver l'Etat, le trône, la monarchie? et que deviendraient les agents de sûreté, de surveillance? Comme le scandale est nécessaire aussi sont les conspirations pour le maintien de la haute police. Les faire naître, les étouffer, charger la mine, l'éventer, c'est le grand art du ministère ; c'est le font et le fin de la science des hommes d'Etat ; c'est la politique transcendante chez nous perfectionneé depuis peu par d'excellents hommes en ce genre, que l'Anglais jaloux veut imiter et contrefait, mais grossièrement. N'y ayant ni complots, ni machinations, ni ramifications, que voulez-vous qu'un ministre fasse de son génie et de son zèle pour la dynastie? Quelle intrigue peut-on entamer avec espoir de le mener à bien, si tout est affiché le même jour? Quelle trame saurait-on mettre sur le métier? Les journaux apprennent aux ministres ce que le public dit, chose fort indifférente ; ils apprennent au public ce que les ministres font, chose fort intéressante, ou ce qu'ils veulent faire, encore meilleur à savoir. Il n'y a nulle parité ; le profit est tout d'une part. Outre que les ministres, dès qu'on sait ce qu'ils veulent faire, aussitôt ne le peuvent ou ne le veulent plus faire. Politique connue, politique perdue ; affaires d'Etat, secrets d'Etat, secrétaires d'Etat! Le secret, en un mot, est l'âme de la politique, et la publicité n'est bonne que pour le public.

From "Œuvres de P.-L.-Courier," published by GARNIER FRÈRES.

RESULT OF THE JANUARY COMPETITION.

The prize is awarded to "Wellington." (Will "Wellington" kindly forward name and address for publication?)

First Class.—Noel, Leonard, Semper eadem, Shax, Tim, Margy, Caterthun, A. C., Kenwyn, Tess, K. B., Fas, Noël, Kettering, Colenso, Caliban, Amateur, Mena, G. C. E., Oak, Pete, Ancilla, Me.

Second Class.—Wip, Novice, Brass bottle, Edelweiss, Cupido, Jean Bonhomme, Failure, Lass of 16, Betty, L. W. B.

The name and address of "Clio," who won the prize in the last Competition, are:—Mrs. S. J. Hooper, 2 Mornington Villas, Blake Hall Road, Wanstead, Essex.

REPORT.

The passage set was not a difficult one, and consequently the differences in merit separating the first half-dozen competitors are not great. The illative force of *aussi*, which we have before remarked on, again escaped some competitors. When used to introduce a conclusion from something which has already been stated, the subject and predicate following them are inverted in order, just as they are when a question is asked. Not a few competitors went gratuitously wrong over the translation of *Il y en a une première, une deuxième*, etc. They insisted on translating it, "There are thus first-class fleets, second-class fleets," etc. The passage means exactly what it says and nothing else. The "first class" of fleets may comprise several fleets, whereas there can be only one "first" fleet.

PRIZE TRANSLATION.

The Pingouins had the finest army in the world. So had the Marsouins. So also had the other nations of Europe, which is not surprising however little one reflects upon it, for every army is the finest in the world. The second army in the world, if such a thing could possibly exist, would be in a position of known inferiority. It would be certain of defeat. It would have to be disbanded immediately. Every army therefore is the finest in the world. The famous French colonel, Marchand, knew this when, in reply to some journalists on the subject of the Russo-Japanese War, before the passage of the Yalu, he had no hesitation in describing both the Russian and Japanese armies as the finest in the world. Moreover, it is worthy of note that even after the most terrible reverses an army does not cease to be the finest in the world; for if nations attribute their victories to the ability of their generals and the courage of their soldiers, they set down their defeats to an inexplicable Fate. Fleets, on the other hand, take rank according to the number of vessels they comprise. There are a first, a second, a third, and so on. No doubt therefore exists as to the issue of naval wars.

The Pingouins had the first army and the second fleet in the world. This fleet was commanded by the famous Chatillon, who bore the title of "émiral ahr," or, more briefly, "émiral." This same word, unfortunately corrupted, is in use yet in several European countries to denote the highest rank in the navy; but as there was only one Pingouin "émiral," a unique distinction, if I may say so, attached to that rank. "WELLINGTON."

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